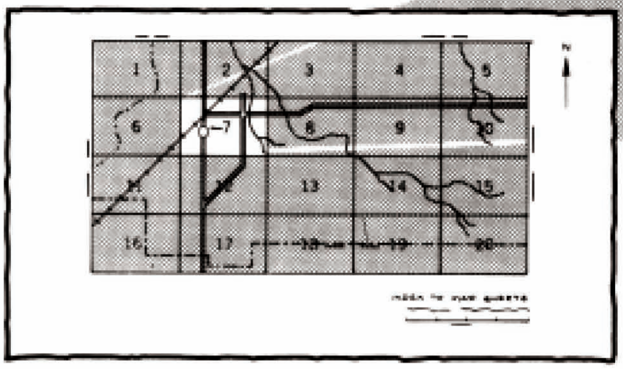
SOIL SURVEY OF

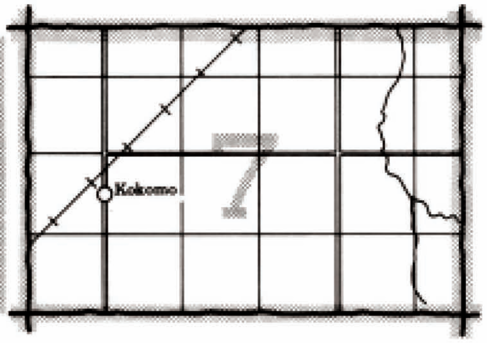
Comanche County, Texas

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Texas Agricultural Experiment Station

HOW TO USE

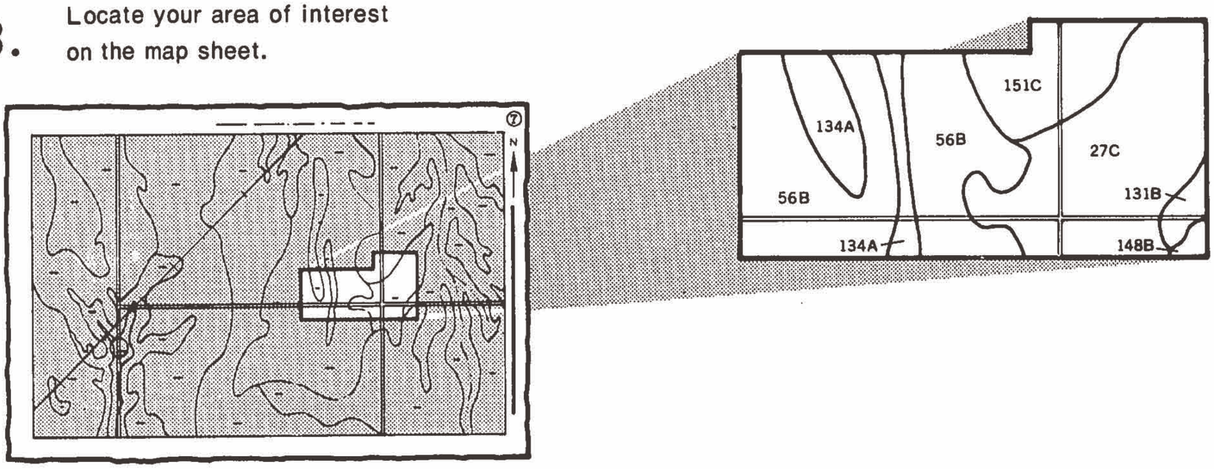
1. Locate your area of interest on the "Index to Map Sheets"



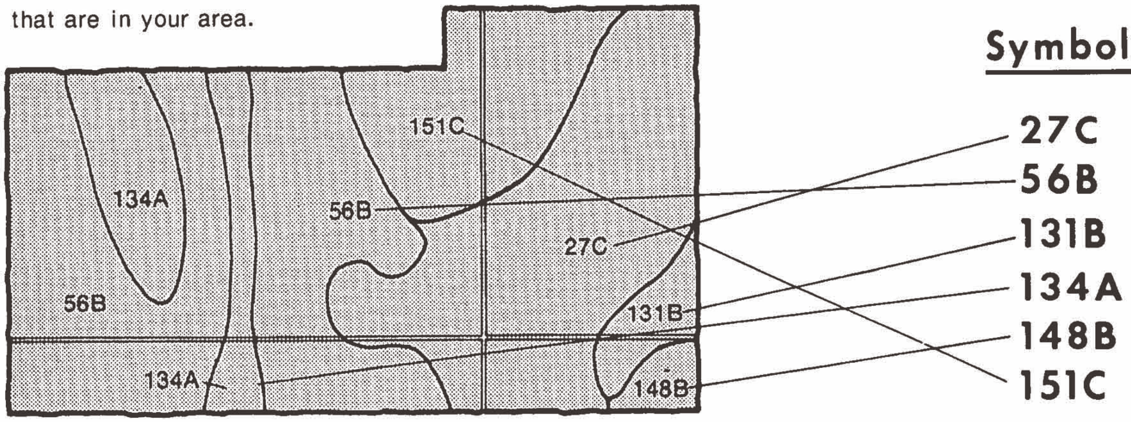


2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



4. List the map unit symbols that are in your area.

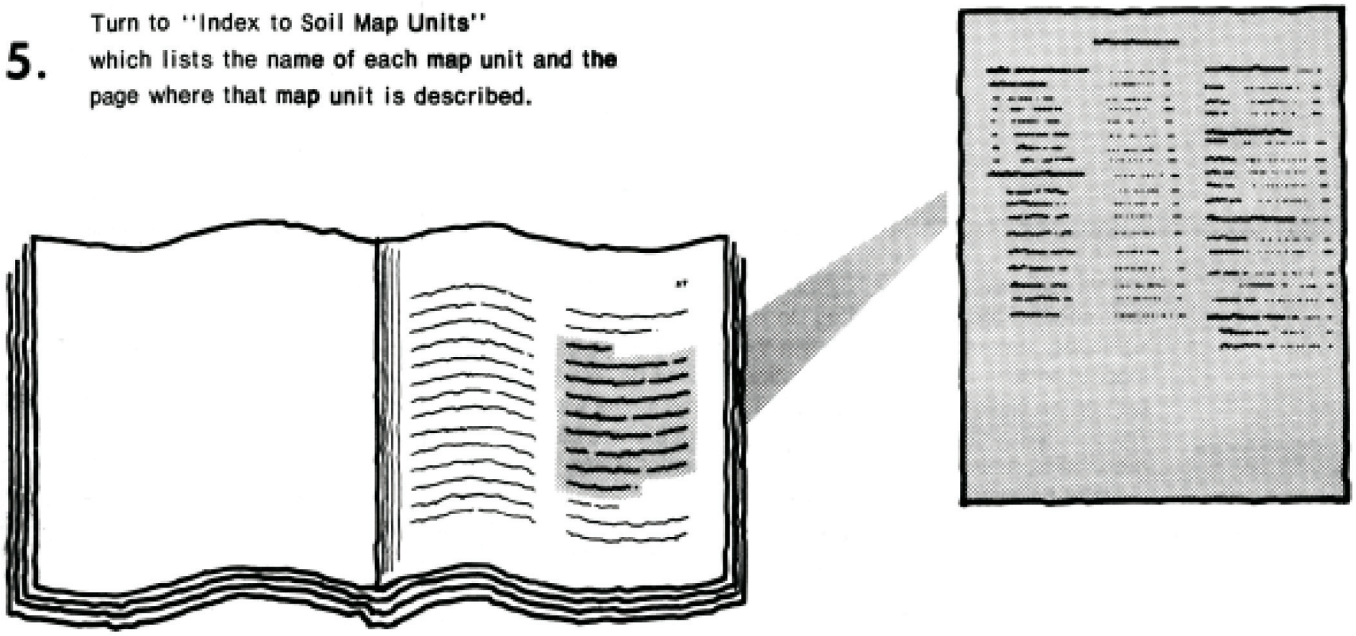


Symbols

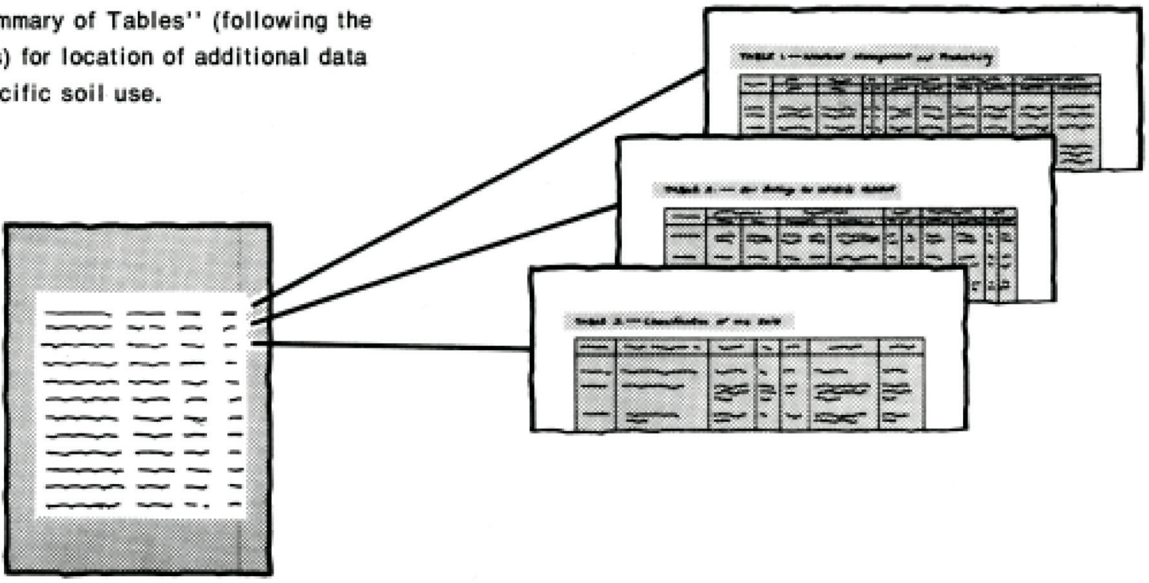
- 27C
- 56B
- 131B
- 134A
- 148B
- 151C

THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1967-74. Soil names and descriptions were approved in 1974. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1974. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Upper Leon Soil and Water Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

Cover picture: Cattle of mixed breeds grazing bermudagrass on Abilene loam, 1 to 3 percent slopes.

Contents

Page

Index to soil map units iv
Summary of tables v
Foreword vii
General nature of the county 1
  Settlement and population 1
  Climate 1
  Agriculture 2
  Natural resources 2
How this survey was made 2
General soil map for broad land use planning 2
  Deep, sandy and loamy soils 3
    1. Chaney-Demona 3
    2. Nimrod-Patilo 4
    3. Pedernales-Menard 4
  Shallow to moderately deep, loamy and clayey soils 4
    4. Purves-Bolar 4
    5. Tarrant 5
    6. Denton-Purves 5
    7. Hensley 5
  Deep, clayey and loamy soils 6
    8. Krum-Lewisville-Abilene 6
    9. Truce-Thurber 6
  Broad land use considerations 7
Soil maps for detailed planning 7
  Soil descriptions 8
Use and management of the soils 37
  Crops and pasture 37
    Yields per acre 38
    Capability classes and subclasses 39
  Rangeland 39
  Engineering 40
    Building site development 41
    Sanitary facilities 42
    Construction materials 43
    Water management 44
  Gardening and landscaping 44
  Recreation 45
  Wildlife habitat 45
Soil properties 47
  Engineering properties 47
  Physical and chemical properties 48
  Soil and water features 49
  Engineering test data 49
Classification of the soils 50
  Soil series and morphology 50

Page

    Abilene series 50
    Bastrop series 50
    Bolar series 51
    Bonti series 51
    Bosque series 51
    Brackett series 52
    Chaney series 52
    Cisco series 52
    Deleon series 53
    Demona series 53
    Denton series 54
    Energy series 54
    Frio series 54
    Hassee series 55
    Heaton series 55
    Hensley series 55
    Karnes series 56
    Krum series 56
    Lamkin series 56
    Leeray series 57
    Lewisville series 57
    Luckenbach series 57
    May series 58
    Menard series 58
    Nimrod series 59
    Owens series 59
    Patilo series 59
    Pedernales series 60
    Purves series 60
    Sunev series 60
    Tarrant series 61
    Thurber series 61
    Truce series 61
    Venus series 62
  Classification 62
Formation of the soils 63
  Factors of soil formation 63
    Climate 63
    Plant and animal life 63
    Parent material 63
    Relief 64
    Time 64
References 64
Glossary 64
Illustrations 69
Tables 81

Issued December 1977

Index to Soil Map Units

Page
AbA—Abilene loam, 0 to 1 percent slopes 8
AbB—Abilene loam, 1 to 3 percent slopes 9
BaC—Bastrop loamy fine sand, 1 to 5 percent slopes 9
BbA—Bastrop fine sandy loam, 0 to 1 percent slopes 9
BbB—Bastrop fine sandy loam, 1 to 3 percent slopes 10
BcB—Bolar clay loam, 1 to 3 percent slopes 10
BcC—Bolar clay loam, 3 to 5 percent slopes 10
BcD—Bolar clay loam, 5 to 8 percent slopes 11
BnB—Bonti fine sandy loam, 1 to 3 percent slopes .. 11
Bo—Bosque loam, occasionally flooded 11
BrC—Brackett-Bolar complex, 1 to 5 percent slopes 12
BsE—Brackett-Karnes complex, 1 to 12 percent slopes 12
BTF—Brackett soils, hilly 13
ChC—Chaney loamy sand, 1 to 5 percent slopes........ 13
ChC2—Chaney loamy sand, 1 to 5 percent slopes, eroded 14
ChD—Chaney loamy sand, 5 to 8 percent slopes 14
CmD—Chaney stony loamy sand, 1 to 8 percent slopes 15
CnD3—Chaney soils, 1 to 8 percent slopes, severely eroded 15
CoC—Cisco loamy fine sand, 1 to 5 percent slopes.... 15
Dc—Deleon clay, occasionally flooded 16
De—Deleon clay, frequently flooded 16
DmC—Demona loamy sand, 0 to 5 percent slopes 17
DnB—Denton silty clay, 1 to 3 percent slopes........ 17
DnC—Denton silty clay, 3 to 5 percent slopes........ 17
Ee—Energy fine sandy loam, occasionally flooded.... 18
Ef—Energy soils, frequently flooded 18
Fr—Frio clay loam, occasionally flooded........ 19
HaA—Hassee loam, 0 to 1 percent slopes........ 19
HaB—Hassee loam, 1 to 3 percent slopes........ 19
HdC—Heaton loamy fine sand, 0 to 5 percent slopes 20
HeB—Hensley loam, 1 to 3 percent slopes........ 20
HnB—Hensley stony loam, 0 to 3 percent slopes 20
KaC—Karnes loam, 1 to 5 percent slopes........ 21
KaD—Karnes loam, 5 to 8 percent slopes........ 21
KcA—Krum silty clay, 0 to 1 percent slopes 21
KcB—Krum silty clay, 1 to 3 percent slopes 21
La—Lamkin clay loam, occasionally flooded........ 22
Lb—Lamkin soils, frequently flooded 22
LcA—Leeray clay, 0 to 1 percent slopes........ 23
LcB—Leeray clay, 1 to 3 percent slopes........ 23
Page
LeB—Lewisville clay loam, 1 to 3 percent slopes 23
LeC—Lewisville clay loam, 3 to 5 percent slopes...... 24
LuB—Luckenbach clay loam, 1 to 3 percent slopes .. 24
MfA—May fine sandy loam, 0 to 1 percent slopes 24
MfB—May fine sandy loam, 1 to 3 percent slopes 25
MnB—Menard fine sandy loam, 1 to 3 percent slopes 25
MnC—Menard fine sandy loam, 3 to 5 percent slopes 25
MnD—Menard fine sandy loam, 5 to 8 percent slopes 26
MsC2—Menard soils, 1 to 5 percent slopes, eroded .. 26
MsD3—Menard soils, 1 to 8 percent slopes, severely eroded 26
NmC—Nimrod fine sand, 0 to 5 percent slopes........ 27
OcC—Owens clay, 1 to 5 percent slopes 27
OwG—Owens stony clay, 3 to 25 percent slopes 28
PaC—Patilo-Nimrod complex, 0 to 5 percent slopes.. 28
PdC—Pedernales loamy fine sand, 1 to 5 percent slopes 29
PeB—Pedernales fine sandy loam, 1 to 3 percent slopes 29
PeC—Pedernales fine sandy loam, 3 to 5 percent slopes 29
PeD—Pedernales fine sandy loam, 5 to 8 percent slopes 30
PsC2—Pedernales soils, 1 to 5 percent slopes, eroded 30
PsD3—Pedernales soils, 1 to 8 percent slopes, severely eroded........ 30
PuB—Purves clay, 1 to 3 percent slopes........ 31
PuC—Purves clay, 3 to 5 percent slopes........ 31
PvG—Purves-Tarrant complex, 8 to 40 percent slopes 31
PXD—Purves-Bolar association, undulating........ 32
SuC—Sunev clay loam, 3 to 5 percent slopes........ 32
SuD—Sunev clay loam, 5 to 8 percent slopes........ 33
TAD—Tarrant association, undulating 33
TAF—Tarrant-Rock outcrop association, hilly........ 34
TrA—Thurber clay loam, 0 to 1 percent slopes........ 34
TrB—Thurber clay loam, 1 to 3 percent slopes........ 34
TuB—Truce fine sandy loam, 1 to 3 percent slopes .. 35
TuC2—Truce fine sandy loam, 1 to 5 percent slopes, eroded 35
TxD—Truce-Bonti complex, 1 to 8 percent slopes 35
TyF—Truce-Rock outcrop complex, 8 to 20 percent slopes 36
VeB—Venus loam, 1 to 3 percent slopes 36

Summary of Tables

Page

Acreage and Proportionate Extent of the Soils (Table 2) 83

Acres. Percent.

Building Site Development (Table 5) 98

Shallow excavations. Dwellings without basements. Dwellings with basements. Small commercial buildings. Local roads and streets.

Classification of the Soils (Table 15) 138

Soil name. Family or higher taxonomic class.

Construction Materials (Table 7) 106

Roadfill. Sand. Gravel. Topsoil.

Engineering Properties and Classifications (Table 11) 122

Depth. USDA texture. Classification—Unified, AASHTO. Fragments greater than 3 inches. Percentage passing sieve number—4, 10, 40, 200. Liquid limit. Plasticity index.

Engineering Test Data (Table 14) 136

Soil name and report no. Depth. Shrinkage—Limit, Linear, Ratio. Mechanical analysis—Percentage passing sieve—2 inches, 3/8 inch, No. 4, No. 10, No. 40, No. 200; Percentage smaller than—0.05 mm, 0.005 mm, 0.002 mm. Liquid limit. Plasticity index. Classification—AASHTO, Unified.

Physical and Chemical Properties of Soils (Table 12) 129

Depth. Permeability. Available water capacity. Soil reaction. Shrink-swell potential. Risk of corrosion—Uncoated steel, Concrete. Erosion factors—K, T. Wind erodibility group.

Potentials and Limitations of Soil Units for Specified Uses (Table 1) 82

Map unit. Extent of area. Cultivated farm crops. Pasture. Range. Urban uses.

Rangeland Productivity and Characteristic Plant Communities (Table 4) 88

Range site name. Potential production—Kind of year, Dry weight. Common plant name. Composition.

Recreational Development (Table 9) 114

Camp areas. Picnic areas. Playgrounds. Paths and trails.

Sanitary Facilities (Table 6) 102

Septic tank absorption fields. Sewage lagoon areas. Trench sanitary landfill. Area sanitary landfill. Daily cover for landfill.

Summary of Tables—Continued

Page

Soil and Water Features (Table 13) 133

Hydrologic group. Flooding—Frequency, Duration, Months. High water table—Depth, Kind, Months. Bedrock—Depth, Hardness.

Water Management (Table 8) 110

Limitations for—Pond reservoir areas, Embankments, dikes, and levees. Features affecting—Drainage, Irrigation, Terraces and diversions, Grassed waterways.

Wildlife Habitat Potentials (Table 10) 118

Potential for habitat elements—Grain and seed crops, Grasses and legumes, Wild herbaceous plants, Shrubs, Wetland plants, Shallow water areas. Potential as habitat for—Openland wildlife, Wetland wildlife, Rangeland wildlife.

Yields Per Acre of Crops and Pasture Plants (Table 3) 85

Peanuts. Grain sorghum. Oats. Improved bermudagrass.

Foreword

The Soil Survey of Comanche County, Texas, contains much information useful in any land-planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

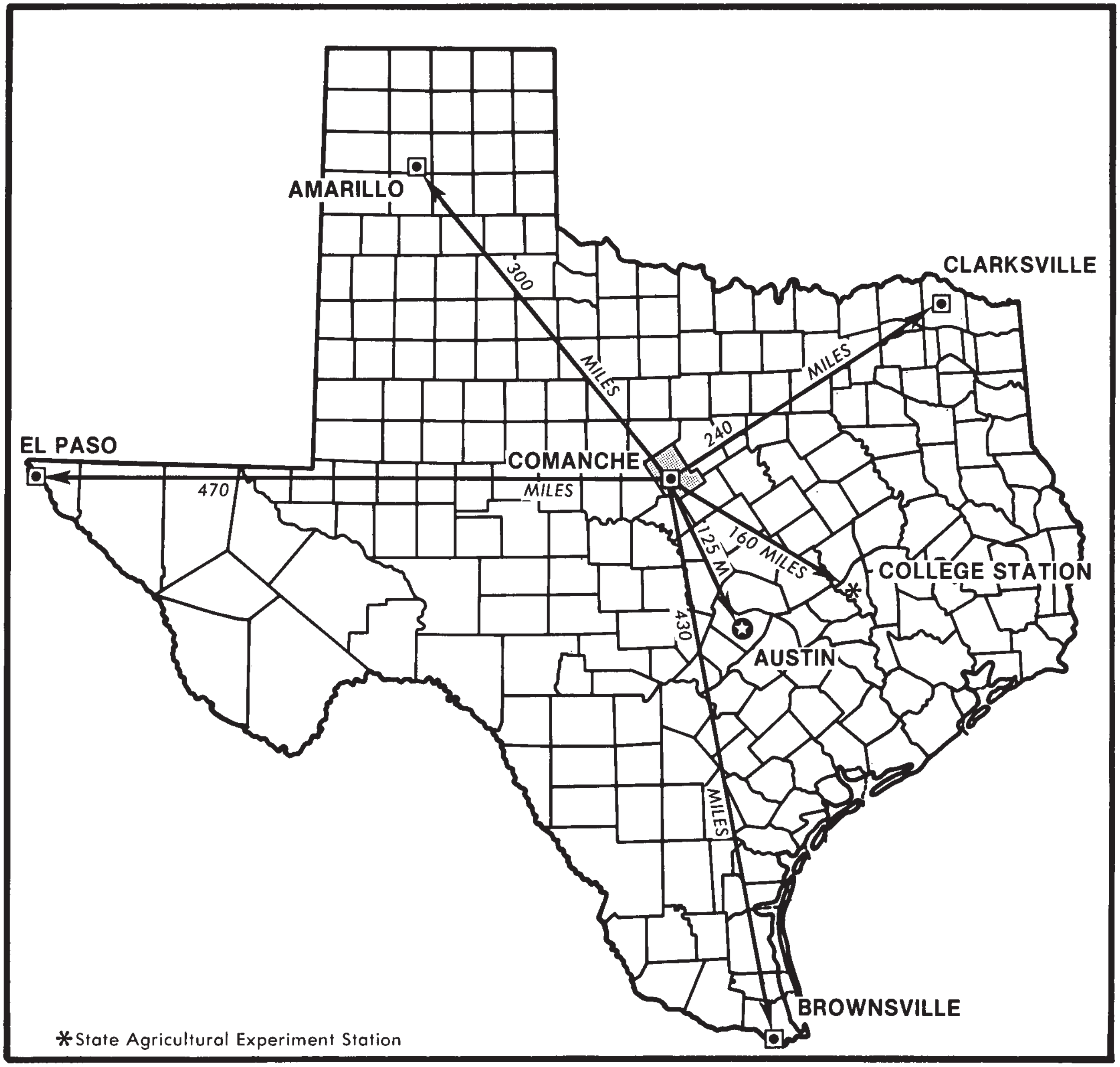
Many people assume that soils are all more or less alike. They are unaware that great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

We believe that this soil survey can help bring us a better environment and a better life. Its widespread use can greatly assist us in the conservation, development, and productive use of our soil, water, and other resources.

George c Marks

George C. Marks
State Conservationist
Soil Conservation Service



Location of Comanche County in Texas.

SOIL SURVEY OF COMANCHE COUNTY, TEXAS

By Joe D. Moore, Billy W. Kendrick, Billy J. Wagner, and Edward R. Harris,
Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service,
in cooperation with Texas Agricultural Experiment Station

COMANCHE COUNTY is near the center of Texas (see map on facing page). The county has an area of 622,080 acres, including water. The landscape ranges from open prairies in the southern part to sandy wooded areas in the central and northern parts and to hilly and broken areas in the western part. The county is drained by numerous streams; the dominant streams are the Leon River, the Sabanna River, and Resley Creek. Elevation ranges from about 650 to 1,700 feet.

Comanche County is agriculturally oriented. About 47 percent of the county is used as rangeland; 32 percent, as pastureland; and 18 percent, as cropland. About 3 percent is used as urban land or for roads, farmsteads, and other miscellaneous uses, or is water. The main crops are peanuts, sorghum, and small grains. Beef cattle and dairy cattle are the major kinds of livestock.

A railroad crosses the county from east to west. Many Federal, State, and farm roads link all parts of the county.

Comanche, the county seat, is near the center of the county. Other urban areas include De Leon, Gustine, Sidney, Proctor, and Lamkin.

General nature of the county

This section gives general information concerning the county. It discusses settlement and population, climate, agriculture, and natural resources.

Settlement and population

Comanche County was created and organized in 1856 from Bosque and Coryell Counties. It was named for the Comanche Indians.

The town of Troy was founded in 1854, and it became the first county seat. Troy, however, was renamed Gustine, and Comanche is now the county seat.

One of the first settlements in the county was the Indian Creek Community east of Comanche; it was settled about 1851. The first wagon road to penetrate this area was the Old Corn Trail near U.S. Highway 67, west of Comanche. This road was used mostly to haul feed, hence the name.

Early settlement was mainly on ranches and farms. This trend has changed little, and urban development has been insignificant. Only about 10 percent of the county's population is within 20 miles of an urban area with population of 5,000 or more. In 1860 the county's population was 709; in 1910, 27,186; and in 1970, 11,898.

Climate

Comanche County does not have an official weather station. Weather data from adjoining Brown and Eastland Counties were consolidated to present the following information on the climate of Comanche County.

Comanche County has a subtropical climate; winters are dry, and summers are humid. Mean total precipitation is about 28 inches annually. There is a wide range in temperature, but the average annual temperature is about 65 degrees. Prevailing winds are southerly to south-southeasterly throughout the year, although northerly winds are common in winter when air mass changes are frequent.

Winter temperatures are mild; on most days they rise above 32 degrees, and in a few nights they drop below 20 degrees. Rapid drops in temperature occur when polar and arctic air masses plunge southward out of Canada, but periods of very cold temperatures rarely last longer than 2 or 3 days. Snowfalls are light; snow generally melts soon after it falls.

Summer daytime temperatures average about 95 degrees. High temperatures are broken by thunderstorm activity on an average of five times a month. High-intensity rains are most common during May, June, and September.

The growing season (frost-free period) is about 240 days. The average date of the first freeze in the fall is November 25.

Agriculture

Rangeland, cropland, and pastureland are the dominant agricultural uses of Comanche County. Most of the southern and western parts of the county are rangeland, and the northern part is dominantly cropland or pastureland. Beef cattle are the main kind of livestock, but many dairy farms are scattered throughout the county. Cultivated areas are mainly in peanuts. Comanche County is one of the leading peanut-producing counties in the United States. The acreage of pastureland increases as marginal cropland or brush areas are established to improved grasses.

The enactment of the Soil Conservation District legislation in 1939 stirred the interest of many landowners in Comanche County. Farmers and ranchers in the county recognized the problems of soil blowing, water erosion, overgrazing of grassland, shortage of livestock watering places, and invasion of brush and noxious weeds. The Upper Leon Soil and Water Conservation District was organized in 1940; it was one of the first districts in Texas.

A succession of dry years in the 1950's forced many farmers to leave their farms. Many acres of cropland were seeded to grass or remained idle. The average size of farms and ranches increased as landowners purchased additional land to make their more mechanized operations economically sound.

About 440,000 acres, or 71 percent of the county, can be used for crops, and the remaining acreage is best suited as rangeland or pastureland.

The capabilities of the soils in Comanche County, the limitations imposed by climate, and the present economic conditions indicate that the future economy of Comanche County will be based on the original mixture of rangeland, cropland, and pastureland.

Natural resources

Soil is the most important natural resource in the county. Livestock that graze the grassland and crops that are produced on farms are the marketable products that are derived indirectly and directly from the soil.

In most of the county, water is adequate for domestic use and for livestock. Numerous lakes, ponds, and rivers provide water for livestock and recreation. No extensive areas of underground water have been found in sufficient volume for irrigation, although numerous shallow wells in the northern part of the county are used for supplemental irrigation.

Oil and gas production is limited. The major area of such production is in the northern part of the county.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show trees, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the section "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and their interpretations are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily useful to different groups of users, among them farmers, managers of rangeland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

General soil map for broad land use planning

The general soil map at the back of this publication shows, in color, the units for broad land use planning described in this survey. Each unit is a unique natural landscape unit that has a distinct pattern of soils and of relief and drainage features. A unit typically consists of one or more soils of major extent and some soils of minor extent. It is named for the major soils. The kinds of soil in one unit can occur in other units, but in a different pattern.

The map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are generally suitable for certain kinds of farming or other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure; the kinds of soils in any one unit ordinarily differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

The units in the survey area vary widely in their potential for major land uses. Table 1 shows the extent of each unit and gives general ratings of the potential of each, in relation to the other units, for each major land use. Adverse soil properties that pose limitations to the use are indicated. The ratings of soil potential are based on the assumption that practices in common use in the county are used to overcome soil limitations. These ratings reflect the ease of overcoming such soil limitations and the probability of soil problems persisting after such practices are used. The location of existing transportation systems or other kinds of facilities is not considered. Each unit is rated for *cultivated farm crops*, *pasture*, *range*, and *urban uses*.

Deep, sandy and loamy soils

This group of soils makes up about 54 percent of the county. The major soils are Chaney, Demona, Nimrod, Patilo, Pedernales, and Menard soils. These are nearly level to sloping soils on uplands. They have a sandy or loamy surface layer and loamy or clayey underlying layers. They are moderately well drained to well drained.

These soils are used mainly as cropland and pasture. The main crops are peanuts, truck crops, sorghum, small grain, and pecan and fruit trees. Coastal bermudagrass, lovegrass, and Kleingrass are the major improved grasses.

The soils have medium potential for urban uses. The chief restrictions are shrink-swell potential and low strength.

1. Chaney-Demona

Nearly level to sloping, deep, sandy soils over sandy clay or sandy clay loam

The soils of this unit are in broad areas on uplands and are dissected by numerous drainageways and streams.

This unit makes up about 43 percent of the county. About 33 percent of the area is Chaney soils, 21 percent is Demona soils, and the remaining 46 percent is minor soils (fig. 1).

Chaney soils have a surface layer of pale brown, neutral loamy sand about 8 inches thick. The subsoil is yellowish red, slightly acid sandy clay to a depth of 20 inches; mottled red, yellowish red, and light brownish gray, slightly acid sandy clay to a depth of 36 inches; and mottled red, brownish yellow, and grayish brown, neutral sandy clay that extends to a depth of about 48 inches. The underlying material, extending to a depth of 62 inches or more, is reddish yellow, moderately alkaline sandy clay.

Demona soils have a surface layer of light yellowish brown, neutral loamy sand to a depth of 6 inches and brown, neutral loamy sand to a depth of 10 inches. The subsurface layer is light brown, neutral loamy sand that extends to a depth of 36 inches. The subsoil is brownish yellow, medium acid sandy clay that is mottled with red and gray to a depth of 52 inches; red, medium acid sandy clay that is mottled with gray and yellow to a depth of 60 inches; and light red, slightly acid sandy clay loam to a depth of 74 inches or more.

Chaney soils are in slightly higher areas than Demona soils in most places. Both soils have lower layers of mottled sandy clay, and both are moderately well drained. They have a surface layer of loamy sand.

Minor soils of this unit are Abilene, Bastrop, Brackett, Cisco, Deleon, Denton, Energy, Hassee, Heaton, Karnes, May, Menard, Nimrod, Owens, Patilo, Pedernales, Lamkin, Tarrant, and Truce soils. Brackett, Menard, Owens, Pedernales, and Truce soils are on convex, low knolls. Abilene, Cisco, and May soils are in broad, shallow valleys of drainageways. Bastrop and Heaton soils are on stream terraces, mostly along the Leon and Sabanna Rivers. Deleon, Energy, and Lamkin soils are on the flood plains of the streams that drain areas of this unit. Nimrod and Patilo soils are in nearly level to undulating, sandy areas. Denton and Tarrant soils are in small areas associated with limestone outcrops. Karnes soils usually are on slopes just above the flood plains. The somewhat poorly drained Hassee soils are in slightly depressional areas on uplands.

This unit is used mainly as cropland, but many areas of pastureland are interspersed with the cropland. Soil blowing is the main limitation of these soils for farming. Wetness is the main limitation for most urban uses.

This unit has high potential for most cultivated farm crops and for pasture grasses. To achieve this potential, proper management to control soil blowing and maintain productivity is required. Careful design and installation practices are needed to overcome wetness for urban uses; this unit has medium potential for most urban uses. Potential for native range plants is medium.

2. Nimrod-Patilo

Nearly level to gently sloping, deep, sandy soils over sandy clay loam

The soils of this unit are in broad, sandy areas with weakly defined drainageways.

This unit makes up about 6 percent of the county. About 51 percent of the area is Nimrod soils, 24 percent is Patilo soils, and the remaining 25 percent is minor soils (fig. 2).

Nimrod soils have a surface layer of pale brown, medium acid fine sand about 6 inches thick. The subsurface layer is very pale brown, slightly acid fine sand that extends to a depth of 26 inches. The subsoil is brownish yellow, medium acid, mottled sandy clay loam to a depth of 34 inches; light gray, strongly acid, mottled sandy clay loam to a depth of 52 inches; and light gray, medium acid, mottled sandy clay loam to a depth of about 72 inches. The underlying material, extending to a depth of 80 inches or more, is light gray, slightly acid, mottled sandy clay loam.

Patilo soils have a surface layer of brown, neutral fine sand about 4 inches thick. The subsurface layer is white, slightly acid fine sand that extends to a depth of 44 inches. The subsoil is mottled light gray, yellow, and red, medium acid sandy clay loam to a depth of 50 inches; light gray, mottled, strongly acid sandy clay loam to a depth of 60 inches; and light gray, strongly acid, mottled sandy clay loam to a depth of 70 inches or more.

Nimrod and Patilo soils are in similar positions on the landscape. They both have a surface layer of fine sand, and both are moderately well drained. They are very susceptible to soil blowing.

Minor soils in this unit are in the Chaney and Demona series. They usually are at slightly higher elevations.

This unit is used mainly as cropland, but many areas of pastureland are interspersed with the cropland. Soil blowing and low available water capacity are the main limitations to use of these soils for farming and for most other purposes.

This unit has medium potential for most cultivated crops. To achieve this potential, supplemental irrigation is occasionally used during the dry summer months. Potential for residential use is medium if soil wetness is overcome. Potential for native range plants and for fertilized pasture grasses is medium.

3. Pedernales-Menard

Gently sloping to sloping, deep, loamy soils over limy sandy clay loam

The soils of this unit are mostly on broad erosional uplands on the northwestern and southeastern edges of the county.

This unit makes up about 5 percent of the county. About 56 percent of the area is Pedernales soils, 19 percent is Menard soils, and the remaining 25 percent is minor soils.

Pedernales soils have a surface layer of brown, neutral fine sandy loam about 4 inches thick. The subsoil is red, neutral sandy clay to a depth of about 14 inches and yellowish red, neutral sandy clay to a depth of about 42 inches. The underlying material, to a depth of 60 inches or more, is reddish yellow sandy clay loam that contains numerous calcium carbonate bodies and concretions.

Menard soils have a surface layer of brown, neutral fine sandy loam about 10 inches thick. The subsoil is yellowish red, slightly acid sandy clay loam to a depth of 18 inches; yellowish red, neutral sandy clay loam to a depth of 30 inches; and reddish yellow, calcareous sandy clay loam to a depth of 34 inches. The underlying material, to a depth of 60 inches or more, is very pale brown, calcareous sandy clay loam.

Pedernales soils are slightly lower in the landscape in most areas than Menard soils. Both soils have a surface layer of mainly hard, crusty fine sandy loam, are usually on convex surfaces, and are well drained.

Minor soils in this unit are Abilene, Chaney, Cisco, Karnes, and May soils. Abilene, Cisco, and May soils are in broad, shallow valleys; Chaney soils are in broad areas on uplands and have plane slopes; and Karnes soils are on slopes adjacent to drainageways.

This unit is mainly used as cropland, but pastureland is scattered throughout the area. The droughty nature of these soils is the main limitation to use for farming, pasture, and range.

This unit has medium potential for most cultivated farm crops, but to achieve this potential, a good cropping system is required. The potential for native range plants and pasture grasses is medium. The potential for most urban uses is high; the moderate shrink-swell potential can be easily overcome by proper design.

Shallow to moderately deep, loamy and clayey soils

This group of soils makes up about 35 percent of the county. The major soils are Purves, Bolar, Tarrant, Denton, and Hensley soils. These are gently sloping to steep soils on uplands and in valleys. They are loamy or clayey throughout.

These soils are used mainly as rangeland. The climax vegetation is mid and tall grasses. A limited acreage is planted to grain sorghum and small grain.

Potential for urban uses is medium. The limitations are stones and shallow depth to rock.

4. Purves-Bolar

Gently sloping to sloping, stony, shallow and moderately deep, clayey and loamy soils over limestone

The soils in this unit are on broad limestone ridges and side slopes that have a benched or stairstep appearance.

This unit makes up about 23 percent of the county. About 30 percent of the area is Purves soils, 26 percent is Bolar soils, and the remaining 44 percent is minor soils (fig. 3).

Purves soils have a surface layer of dark grayish brown, calcareous stony clay about 18 inches thick. The underlying material is hard, white limestone. Limestone fragments 6 to 30 inches in diameter cover 1 to 20 percent of the surface.

Bolar soils have a surface layer of dark grayish brown, calcareous stony clay loam about 18 inches thick. The subsoil is yellowish brown, calcareous loam to a depth of 30 inches and light yellowish brown, calcareous clay loam to a depth of 36 inches. The underlying material is hard limestone somewhat interbedded with clayey marl.

Purves soils are usually on the upper parts of ridges, and Bolar soils are usually on the lower parts of slopes. Both soils are stony, and both are shallow to moderately deep over limestone.

Minor soils in this area are Abilene, Bosque, Brackett, Denton, Frio, Karnes, Krum, Lewisville, Sunev, and Tarrant soils. Abilene, Denton, and Krum soils are in broad, shallow valleys. Bosque and Frio soils are on the flood plains of the streams that drain this area. Brackett, Karnes, Lewisville, and Sunev soils are on slopes or foot slopes adjacent to drainageways. Tarrant soils are dominantly on breaks.

This unit is used mainly as rangeland. The soils are shallow to moderately deep, and depth is the main limitation to use of these soils as rangeland.

This unit has medium potential for native range plants. To achieve this potential, proper grazing use, which includes adequate rest periods, and brush management are required. The potential for crops and pasture grasses is low because of stones on the surface and depth of soil to rock. The potential for most urban uses is medium. Large stones on the surface, depth to rock, and slopes need to be overcome in the installation of structures or utilities.

5. Tarrant

Gently sloping to steep, cobbly, shallow, clayey soils over limestone

The soils in this unit are on gently sloping plateaus or flat topped mesas and steep side slopes adjacent to drainageways.

This unit makes up about 7 percent of the county. About 55 percent of the area is Tarrant soils, and the remaining 45 percent is minor soils.

Tarrant soils have a surface layer of very dark grayish brown, calcareous cobbly clay about 16 inches thick. Limestone fragments make up about 20 percent of the upper 4 inches and about 60 percent of the lower 12 inches. Below a depth of 16 inches is hard, fractured, limestone bedrock.

Minor soils of this unit are Bosque, Brackett, Denton, Frio, Hensley, Karnes, and Purves soils. Bosque and Frio soils are along flood plains. Brackett and Karnes soils are on low knolls or sharp breaks on slopes. Denton and Purves soils are near the centers of large mapped areas on plane slopes. Hensley soils are near the centers of mapped areas on gently sloping plateaus.

This unit is used mainly as rangeland. Live oak and Texas oak are scattered throughout. Shallow soil depth is the main limitation to use of these soils as rangeland.

This unit has low potential for native range plants; however, the area is best suited to this use. To achieve even this potential, proper grazing use, which includes adequate rest periods, and brush management are required. Potential for cropland, pastureland, and most urban uses is low because of shallow soil depth to hard limestone bedrock and large stones on the surface. Potential for wildlife habitat is medium. An abundance of forbs, browse plants, and cover provides favorable habitat for deer.

6. Denton-Purves

Gently sloping, moderately deep to shallow, clayey soils over limestone

The soils in this unit are in concave valleys and on prairies.

This unit makes up about 4 percent of the county. About 40 percent of the area is Denton soils, 22 percent is Purves soils, and 38 percent is minor soils.

Denton soils have a surface layer of calcareous silty clay about 24 inches thick. The upper 12 inches is very dark grayish brown, and the lower 12 inches is dark brown. The subsoil is light brown, calcareous silty clay that extends to a depth of 30 inches. The underlying material is very pale brown marly clay loam that extends to a depth of about 36 inches and that overlies hard limestone.

Purves soils have a surface layer of calcareous clay about 16 inches thick. The upper 7 inches is dark grayish brown, and the lower 9 inches is dark brown. It is underlain by hard limestone.

Denton soils are usually lower in the landscape than Purves soils. Both soils have a clayey surface layer that is very sticky and plastic when wet and that is moderately deep to shallow over limestone.

Minor soils in this unit are Bolar, Brackett, Karnes, Krum, Leeray, and Lewisville soils. Bolar, Brackett, and Karnes soils are on low knolls. Leeray soils have plane slopes and have gilgai relief. Krum and Lewisville soils are on side slopes adjacent to streams.

This unit is used mainly as rangeland. It has high potential for native range plants and medium potential for pasture grasses.

A limited acreage is used as cropland. Potential for most cultivated farm crops is medium. Some of the soils are terraced for erosion control. The shallow soils, however, are difficult to terrace and are better suited to drilled or closely spaced crops. Potential for most urban uses is medium if shrink-swell potential, depth to bedrock, slow water intake, and low strength are overcome in design of structures or in modification of the soils.

7. Hensley

Gently sloping to sloping, stony, shallow, loamy soils over limestone

The soils in this unit are in a small area in the northern part of the county.

This unit makes up about 1 percent of the county. About 85 percent of the area is Hensley soils, and the remaining 15 percent is minor soils.

Hensley soils have a surface layer of reddish brown, neutral stony loam about 5 inches thick. Flat limestone fragments, 6 to 30 inches across the long axis, make up about 2 percent of the surface layer and cover about 5 percent of the surface. The subsoil is red, neutral clay about 13 inches thick. At a depth of 18 inches is hard limestone bedrock.

Minor soils in this unit are Tarrant and Leeray soils. Tarrant soils usually are on low ridges. Leeray soils are on plane slopes that have gilgai relief.

This unit is used as rangeland. Shallow soil depth and low amounts of water held by the soil for plant use are the main limitations of these soils for rangeland.

This unit has medium potential for native range plants. Proper grazing use, which includes adequate rest periods, and brush management are required to achieve this potential. Potential for crops and pasture grasses is low. Potential for most urban uses is medium because of shallow depth to rock and stones on the surface. Potential for wildlife habitat is high; deer find favorable browse and cover.

Deep, clayey and loamy soils

This group of soils makes up about 11 percent of the county. The major soils are Krum, Lewisville, Abilene, Truce, and Thurber soils. They are nearly level to gently sloping soils in valleys. The soils are clayey or loamy throughout. They are moderately well drained and well drained.

These soils are used mainly for cropland. Sorghum and small grain are the major crops grown.

Potential for urban uses is medium. The main restrictions are low strength and shrink-swell.

8. Krum-Lewisville-Abilene

Nearly level to gently sloping, deep, loamy and clayey soils over limy silty clay loam or clay loam

The soils in this unit are in long, narrow, concave valleys in the western part of the county.

This unit makes up about 8 percent of the county. About 19 percent of the area is Krum soils, 18 percent is Lewisville soils, 14 percent is Abilene soils, and the remaining 49 percent is minor soils.

Krum soils have a surface layer of dark grayish brown, calcareous silty clay about 36 inches thick. The subsoil is brown, calcareous silty clay that extends to a depth of 56 inches. The underlying material, to a depth of 62 inches or more, is pale brown, calcareous silty clay loam.

Lewisville soils have a surface layer of dark grayish brown, calcareous clay loam about 18 inches thick. The subsoil is light brownish gray, calcareous silty clay loam to a depth of 26 inches; pale brown, calcareous silty clay loam to a depth of 46 inches; and light yellowish brown, calcareous clay loam to a depth of 62 inches or more.

Abilene soils have a surface layer of dark grayish brown, neutral loam about 6 inches thick. The subsoil is very dark grayish brown, neutral clay loam to a depth of 22 inches and dark grayish brown, calcareous clay loam to a depth of 48 inches. The underlying material, to a depth of 62 inches or more, is very pale brown, calcareous sandy clay loam. Concretions of calcium carbonate make up about 20 percent, by volume, of the underlying material.

These soils all are in low lying areas, usually adjacent to a stream or drainageway. Krum soils crack when dry and are sticky and plastic when wet; Lewisville and Abilene soils are less sticky and plastic when wet. All three soils are deep and well drained.

Minor soils in this soil area are Bosque, Denton, Frio, Karnes, Luckenbach, Purves, Sunev, and Venus soils. Bosque and Frio soils are on flood plains. Venus soils are on terraces adjacent to the flood plains. Karnes and Sunev soils are in narrow bands along slopes adjacent to the drainageways. Luckenbach, Purves, and Denton soils are in broad, gently sloping areas on uplands.

This unit is used mainly as cropland. Soil erosion in the more sloping areas is the main limitation to use of these soils for farming.

This unit has high potential for most cultivated crops. To achieve this potential, erosion control by terraces or use of crop residue is required. Potential for native range plants and pasture grasses is high. Potential for most urban uses is medium because the soils shrink when dry and swell when wet.

9. Truce-Thurber

Nearly level to gently sloping, deep, loamy soils over shaly clay or clay

This unit consists of shallow valleys and sandstone ridges in the northwestern part of the county.

The unit makes up about 3 percent of the county. About 40 percent of the area is Truce soils, 17 percent is Thurber soils, and the remaining 43 percent is minor soils (fig. 4).

Truce soils have a surface layer of brown, slightly acid fine sandy loam about 3 inches thick. The subsurface layer is pale brown, slightly acid fine sandy loam that extends to a depth of 5 inches. The subsoil is yellowish red, neutral clay to a depth of 12 inches; brown, neutral clay to a depth of 30 inches; and yellowish brown, calcareous clay to a depth of 48 inches. The underlying material, to a depth of 60 inches or more, is olive yellow shaly clay.

Thurber soils have a surface layer of brown, neutral clay loam about 8 inches thick. The subsoil is dark grayish brown, neutral clay to a depth of 26 inches; brown, moderately alkaline clay that contains a few calcium carbonate concretions and that extends to a depth of 36 inches; and brown, calcareous clay that extends to a depth of 50 inches. The underlying material, to a depth of 64 inches or more, is yellowish brown, calcareous clay.

Truce soils are on convex surfaces, and Thurber soils are in lower areas. Truce soils are well drained, and Thurber soils are moderately well drained. Both have a surface layer that crusts, and both are very hard when dry.

Minor soils in this unit are Bonti, Chaney, Energy, Leeray, and Owens soils. Bonti soils are on ridgetops. Chaney soils are in small sandy areas. Energy soils are on flood plains. Leeray soils are on broad flats and have gilgai relief. Owens soils are on low knolls or steep slopes.

This unit is used mainly as rangeland. A few areas of the Thurber soils are planted to small grain or forage sorghum. Surface crusting and the slow to very slow water intake rate are the main limitations to use of these soils for rangeland, farming, and most other purposes.

This unit has medium potential for cool season crops and low potential for most summer crops. To achieve this potential, a cropping system that helps control erosion, makes the most efficient use of moisture, and maintains soil tilth is required. Terraces are used in some areas to help control runoff and erosion. Potential is medium for native range plants and low for pasture grasses. The area has medium potential for most urban uses because of shrink-swell potential, slow water intake rate, and low strength for roads, foundations, and dwellings.

Broad land use considerations

The units in the county vary widely in their potential for major land uses, as indicated in table 1. General potentials and limitations for various land uses are shown for each unit. The ratings of soil potential reflect the relative cost of such practices and the hazard of continued soil-related problems after such practices have been installed. The ratings do not consider location in relation to existing transportation systems or to other kinds of facilities.

Each unit is rated for cultivated farm crops, pasture, range, and urban uses. Cultivated farm crops grown extensively include peanuts, grain sorghum, wheat, and oats. Pasture refers to land in improved grasses, such as bermudagrass or Kleingrass. Range refers to land managed for native range plants. Urban uses include residential, commercial, and industrial land uses.

Six of the nine units in Comanche County have favorable potential for cultivated farm crops. The areas are identified on the General Soil Map at the back of this publication. The moderately deep to deep, sandy and loamy soils in the Chaney-Demona, Nimrod-Patilo, and Pedernales-Menard units are dominantly in peanuts, grain sorghum, peach or pecan orchards, and truck crops. In these areas, the dominant soils are Chaney, Demona, Nimrod, and Pedernales soils. The soils in the Denton-Purves unit and the deep, clayey and loamy soils in the Krum-Lewisville-Abilene and Truce-Thurber units are dominantly in grain sorghum, cotton, wheat, and oats. The dominant soils in these areas are Krum, Denton, Lewisville, Abilene, Truce, and Thurber soils.

The Chaney-Demona and Krum-Lewisville-Abilene units have high potential for pasture grasses. The Nimrod-Patilo, Pedernales-Menard, and Purves-Bolar map units have medium potential for pasture grasses. These areas, when managed for improved pasture, are dominantly in bermudagrass, Kleingrass, or lovegrass. Well managed pasture requires rotation grazing, proper stocking rate, weed control, fertilization, and an adequate supply of livestock water.

Most soils in the county have favorable potential for native range plants. The climax plant communities range from open prairies with short grasses to wooded areas of oak trees and tall grasses. The areas used as rangeland also double as wildlife habitat areas. Some of the shallow, stony soils, such as Tarrant and Hensley soils, provide a favorable habitat for deer and turkey. Potentials for wildlife are discussed in the section "Use and management of the soils."

About 8,000 acres have been developed for urban uses in Comanche County. Comanche, De Leon, and the area around Lake Proctor are the major urban areas. Most units in the county have limitations that affect urban development. These limitations range from wetness in the Chaney-Demona and Nimrod-Patilo units to shallow depth to hard bedrock in the Tarrant and Hensley units. The Purves-Bolar, Tarrant, Denton-Purves, and Hensley units are underlain by rock, which causes limitations for some uses; these limitations are difficult to overcome. These areas, however, have esthetic values that occasionally overcome all other limitations. The other units have limitations that can be overcome by proper design and installation procedures. Flooding is a limitation on parts of several units, especially the Chaney-Demona and Krum-Lewisville-Abilene units. Sizable parts of these areas are flooded, mainly along the Leon and Sabanna Rivers.

Soils information can be used as a guide in planning the orderly growth and development of the county. It is especially helpful in determining which lands to allocate to each use.

Soil maps for detailed planning

The kinds of soil (map units) shown on the detailed soil maps at the back of this publication are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each soil is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the unit on the detailed soil map. Each map unit description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated and the management concerns and practices needed are discussed.

A soil map unit represents an area on the landscape and consists mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map at the back of this publication are phases of soil series.

Soils that have profiles that are almost alike make up a *soil series.* Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. All the soils in the United States having the same series name have essentially the same properties that affect their use and their response to management practices.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristic that affects the use of the soils. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Bastrop fine sandy loam, 0 to 1 percent slopes, is one of several phases within the Bastrop series.

Some map units are made up of two or more dominant kinds of soil. Three such kinds of map units are shown on the soil map of this survey area: soil complexes, soil associations, and undifferentiated groups.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Patilo-Nimrod complex, 0 to 5 percent slopes, is an example.

A *soil association* is made up of soils that are geographically associated and are shown as one unit on the map. A soil association has considerable regularity in geographic pattern and in the kinds of soil that make up the associaton. The extent of the soils can differ appreciably from one delineation to another; nevertheless, interpretations can be made for the expected uses of the soils. Purves-Bolar association, undulating, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because there is little value in separating them. The pattern and proportion of the soils are not uniform. An area shown on the map has at least one of the dominant (named) soils or may have all of them. Lamkin soils, frequently flooded, is an undifferentiated group in this survey area.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. The soils that are included in mapping are recognized in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Rock outcrop is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 2, and additional information on properties, limitations, capabilities, and potentials for many soil uses are given for each kind of soil in other tables in this survey. (See "Summary of Tables.") Many of the terms used in describing soils are defined in the Glossary.

Soil descriptions

AbA—Abilene loam, 0 to 1 percent slopes. This deep, well drained, nearly level, loamy soil is on uplands. Areas are long and narrow to oval and range from 5 to 100 acres, but dominantly are about 25 acres.

The surface layer is very dark grayish brown, neutral loam about 10 inches thick. The subsoil is dark brown, moderately alkaline clay loam to a depth of 26 inches; brown, moderately alkaline, calcareous clay loam to a depth of 38 inches; and brown, calcareous clay loam that contains common concretions of calcium carbonate and that extends to a depth of 44 inches. The underlying material, to a depth of 60 inches or more, is light brown, calcareous clay loam that contains common bodies and concretions of calcium carbonate.

This soil is productive. Organic matter content is high. Permeability is moderately slow, and available water capacity is high. The soil has good tilth and can be worked over a wide range of moisture conditions. The root zone is deep and easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Abilene soils that have a surface layer of clay loam. May soils near drainageways and Hassee soils in depressional areas are also included. Included soils make up less than 20 percent of any mapped area.

This soil is mainly used as cropland. Potential for crops such as grain sorghum and small grain is high. Crop residue left on the surface helps conserve moisture, slow runoff, reduce soil temperature, and maintain soil tilth and productivity. Crops on this soil respond well to fertilization. Potential for pasture is high; Kleingrass and bermudagrass are well suited to this soil.

This soil has high potential for native range plants. The climax plant community is a mixture of tall and mid grasses and scattered Texas oak and live oak trees. Major management concerns include proper grazing use, which includes adequate rest periods, and brush management.

This soil has high potential for most urban uses. Shrink-swell potential and low strength are limitations, but they can be easily overcome by good design and careful installation procedures. The clay loam lower layers take in water more slowly than the optimum rate for septic tank absorption fields, but this can be overcome by increasing the size of the absorption area or by modifying the filter field itself. Capability subclass IIc; Clay Loam range site.

AbB—Abilene loam, 1 to 3 percent slopes. This deep, well drained, gently sloping, loamy soil is on uplands in shallow valleys. Areas are irregularly shaped and range from 5 to 100 acres, but are dominantly about 15 acres.

The surface layer is dark grayish brown, neutral loam about 6 inches thick. The subsoil is very dark grayish brown, neutral clay loam to a depth of 22 inches; dark grayish brown, calcareous clay loam to a depth of 34 inches; and dark grayish brown, calcareous clay loam to a depth of 48 inches. The underlying material, which extends to a depth of about 62 inches or more, is very pale brown, calcareous sandy clay loam that contains about 20 percent, by volume, concretions of calcium carbonate.

This soil is productive. It is high in organic matter content. Permeability is moderately slow, and available water capacity is high. The soil has good tilth and can be worked throughout a wide range of moisture conditions. The root zone is deep and easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of May, Hassee, and Lewisville soils. Also included are small areas of Abilene soils that have a surface layer of clay loam. These included soils occur at random within mapped areas. They are usually in areas of less than 3 acres and together make up less than 20 percent of any mapped area.

This soil is mostly used as cropland. It has high potential for crops such as grain sorghum and small grain. Its potential is limited only by the size of its areas. Terraces and contour cultivation help control erosion. Crop residue left on the surface helps conserve moisture and maintain tilth and productivity. Crops on this soil respond well to fertilization. Tillage should be timely and limited. The potential for pasture is high; improved grasses such as Kleingrass and bermudagrass are well suited to this soil.

This soil has high potential for native range plants. The climax plant community is a mixture of tall and mid grasses and scattered Texas oak, live oak, and juniper. Management concerns are proper grazing use, which includes adequate rest periods, and brush management.

This soil has high potential for most urban uses. Shrink-swell potential and low strength are limitations, but they can be easily overcome by good design and careful installation procedures. The clay loam lower layers take in water more slowly than the optimum rate for septic tank absorption fields, but this can be overcome by increasing the absorption area or by modifying the filter field itself. Capability subclass IIe; Clay Loam range site.

BaC—Bastrop loamy fine sand, 1 to 5 percent slopes. This deep, well drained, gently sloping, sandy soil is on stream terraces. Areas are irregularly shaped and range from 5 to 150 acres.

The surface layer is brown, slightly acid loamy fine sand about 14 inches thick. The subsoil is yellowish red, neutral sandy clay loam to a depth of 24 inches; yellowish red, neutral sandy clay loam to a depth of 48 inches; strong brown, mildly alkaline sandy clay loam to a depth of 60 inches; and reddish yellow, mildly alkaline sandy clay loam to a depth of 75 inches or more.

Permeability is moderate, and available water capacity is medium. The soil can be worked over a wide range of moisture conditions. The root zone is deep and easily penetrated by plant roots. The hazard of soil blowing is severe, and the hazard of water erosion is moderate.

Included with this soil in mapping are small areas, less than 5 acres in size, of Chaney, Hassee, Heaton, and Pedernales soils. Chaney and Pedernales soils are usually on slightly higher knolls. Hassee soils are in small depressional, circular areas. Heaton soils are usually near the edges of mapped areas where sand has accumulated to thicken the surface layer. These included soils together make up less than 20 percent of any mapped area, and no soil individually makes up more than 15 percent of any mapped area.

This soil is mainly used as cropland. The potential for crops is high. Peanuts, sorghums, and truck crops are the major crops, and fruit and nut trees are well suited. Cover cropping, wind stripcropping, and returning crop residue to the soil help control soil blowing and improve soil productivity. Crops on this soil respond well to fertilization. Potential for pasture is high. Bermudagrass and lovegrass are well suited to this soil.

The soil has high potential for native range plants. The climax plant community is an open savannah of tall trees with an understory of tall and mid grasses. Major management concerns are proper grazing use, which includes adequate rest periods, and brush control.

Potential for most urban uses is high. Capability subclass IIIe; Loamy Sand range site.

BbA—Bastrop fine sandy loam, 0 to 1 percent slopes. This deep, well drained, nearly level, loamy soil is on stream terraces. Areas are irregularly shaped and range from 5 to 130 acres.

The surface layer is brown, slightly acid fine sandy loam to a depth of 5 inches and light brownish gray, neutral fine sandy loam to a depth of 12 inches. The subsoil is yellowish red, slightly acid sandy clay loam to a depth of 26 inches; reddish yellow, slightly acid sandy clay loam to a depth of 36 inches; and reddish yellow, neutral, sandy clay loam to a depth of 64 inches. The underlying material, extending to a depth of 70 inches or more, is light brown, moderately alkaline sandy loam.

Permeability is moderate, and available water capacity is high. Tilth is fair; the soil can be worked over a wide range of moisture conditions. The root zone is deep and easily penetrated by plant roots. The hazard of water erosion is slight, and the hazard of soil blowing is moderate.

Included with this soil in mapping are small areas, less than 5 acres in size, of Pedernales and Menard soils. These included soils are usually on slightly convex knolls and together make up less than 15 percent of any mapped area.

This soil is used mainly as cropland. Potential for crops is high. Peanuts, sorghums, and truck crops are the major crops. Fruit and nut trees are also well suited to this soil. Cover cropping and returning plant residue to the soil help control erosion and maintain productivity. Crops on this soil respond well to fertilization. Potential for pasture is high. Bermudagrass, Kleingrass, and lovegrass are well suited to this soil.

Potential for native range plants is high. The climax plant community is an open savannah of post oak trees and an understory of tall and mid grasses. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential for most urban uses is high. Capability class I; Sandy Loam range site.

BbB—Bastrop fine sandy loam, 1 to 3 percent slopes. This deep, well drained, gently sloping, loamy soil is on stream terraces. Slopes are plane to slightly convex. Soil areas range from 5 to 160 acres and are irregularly shaped.

The surface layer is brown, neutral fine sandy loam about 8 inches thick. The subsoil is red, neutral sandy clay loam to a depth of 28 inches; red, slightly acid sandy clay loam to a depth of 48 inches; and yellowish red, slightly acid sandy clay loam to a depth of 70 inches or more.

Permeability is moderate, and available water capacity is high. Tilth is fair; the soil can be worked over a wide range of moisture conditions. The root zone is deep and easily penetrated by plant roots. The hazards of water erosion and soil blowing are moderate.

Included with this soil in mapping are small areas, less than 5 acres in size, of Pedernales and Menard soils. These included soils are usually on slightly convex knolls and together make up less than 20 percent of any mapped area.

This soil is mainly used as cropland. Potential for crops such as peanuts, sorghums, and truck crops is high. Fruit and nut trees are also well suited. Terraces, contour cultivation, and return of crop residue to the soil help control erosion, conserve moisture, and maintain production. Crops on this soil respond well to fertilization. Potential for pasture grasses is high. Bermudagrass, Kleingrass, and lovegrass are well suited to this soil.

Potential for native range plants is high. The climax plant community is an open savannah of post oak trees with an understory of tall and mid grasses. Major management concerns are proper grazing use with adequate rest periods and brush control.

Potential for most urban uses is high. Capability subclass IIe; Sandy Loam range site.

BcB—Bolar clay loam, 1 to 3 percent slopes. This moderately deep, well drained, gently sloping, loamy soil is in broad areas on uplands. Soil areas are irregularly shaped and range from 10 to 200 acres.

The surface layer is very dark grayish brown, calcareous clay loam about 16 inches thick. The upper part of the subsoil is brown, calcareous loam that contains many films and threads and common concretions of calcium carbonate and that extends to a depth of 28 inches. The lower part is very pale brown, calcareous loam that contains many concretions and soft bodies of calcium carbonate and that extends to a depth of 38 inches. Below that is limestone interbedded with marly clays.

This is a productive soil. Organic matter content is high. Permeability is moderate, and available water capacity is medium. The soil has good tilth and can be worked over a wide range of moisture conditions. The root zone is moderately deep and easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Brackett, Karnes, and Purves soils. Brackett and Karnes soils are on low knolls or breaks in the slope. The shallow Purves soils are on plane surfaces near the edges of more sloping soils. These included soils are usually in areas of less than 10 acres and together make up less than 20 percent of any mapped area.

This soil is dominantly used as rangeland. Potential for native range plants is high. The climax plant community is an open prairie supporting an abundant growth of mid and tall grasses; woody plants are not significant in the climax vegetation. Management concerns include proper grazing use, which includes adequate rest periods, and brush management.

This soil has medium potential for crops such as grain sorghum, forage sorghum, and small grain. Terraces and contour cultivation help control erosion. Crop residue left on the surface helps conserve moisture and maintain tilth and productivity. Tillage should be timely and limited. Potential for pasture grasses is medium. Improved grasses, such as Kleingrass, are well suited to this soil.

This soil has medium potential for most urban uses. Depth to rock and low strength are difficult to overcome. Capability subclass IIe; Clay Loam range site.

BcC—Bolar clay loam, 3 to 5 percent slopes. This moderately deep, well drained, gently sloping, loamy soil is in convex areas on uplands. Areas are irregularly shaped and range from 10 to 200 acres.

The surface layer is dark grayish brown, calcareous clay loam about 18 inches thick. The subsoil is yellowish brown, calcareous loam to a depth of 30 inches and light yellowish brown, calcareous loam to a depth of 36 inches. Below that is hard limestone somewhat interbedded with clayey marl.

This is a productive soil. Organic matter content is high. Permeability is moderate, and available water capacity is medium. The soil has good tilth and can be worked over a wide range of moisture conditions. The root zone is moderately deep and easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Brackett and Purves soils. Brackett soils are on low knolls, and Purves soils have plane surfaces. These included soils are in areas of less than 10 acres and together make up less than 20 percent of any mapped area.

This soil is mostly used as rangeland. Potential for native range plants is high. The climax plant community is an open prairie supporting an abundant growth of mid and tall grasses; woody plants are not significant in the climax vegetation. Management concerns include proper stocking, controlled grazing, and brush management.

This soil has medium potential for crops, such as forage sorghums, grain sorghum, and small grain. Terraces and contour cultivation help control erosion. Crop residue left on the surface helps conserve moisture and maintain tilth and productivity. Tillage should be timely and limited. Potential for pasture grasses is medium. Improved grasses, such as Kleingrass and King Ranch bluestem, are well suited to this soil.

This soil has medium potential for most urban uses. Depth to rock and low strength are difficult to overcome. Capability subclass IIIe; Clay Loam range site.

BcD—Bolar clay loam, 5 to 8 percent slopes. This moderately deep, well drained, sloping, loamy soil is in convex areas on uplands. Soil areas are irregularly shaped and range from 5 to 200 acres.

The surface layer is dark brown, calcareous clay loam about 10 inches thick. The upper part of the subsoil is yellowish brown, calcareous loam that extends to a depth of 32 inches. The lower part is a layer of white loamy material that extends to hard limestone bedrock at a depth of 36 inches.

This soil has high productivity. Organic matter content is high. Permeability is moderate, and available water capacity is medium. The soil has good tilth and can be worked over a wide range of moisture conditions. The root zone is moderately deep and easily penetrated by plant roots. The hazard of water erosion is severe, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas, less than 5 acres in size, of Brackett, Karnes, and Sunev soils. Brackett soils are usually on the upper parts of slopes, and Karnes and Sunev soils are on the lower parts. These included soils together make up less than 20 percent of any mapped area.

This soil is mostly used as rangeland. Potential for native range plants is high. The climax plant community is an open prairie supporting an abundant growth of mid and tall grasses; woody plants are not significant in the climax vegetation. Management concerns include proper stocking, controlled grazing, and brush management.

This soil has low potential as cropland. Close-growing crops, such as forage sorghum and small grain, are best suited. The erosion hazard is severe where cultivated crops are grown. Slope creates limitations that are difficult to overcome even if terraces are built, contour cultivation is practiced, or crop residue is left on the surface. Potential for pasture grasses is medium. Improved grasses such as Kleingrass and King Ranch bluestem are well suited to this soil.

This soil has medium potential for most urban uses. Depth to rock and low strength are difficult to overcome. Capability subclass IVe; Clay Loam range site.

BnB—Bonti fine sandy loam, 1 to 3 percent slopes. This moderately deep, well drained, gently sloping, loamy soil is on convex ridgetops on uplands. Areas are irregularly shaped and range from 5 to 50 acres.

The surface layer is brown, slightly acid fine sandy loam about 8 inches thick. The subsoil is red, medium acid sandy clay to a depth of 22 inches and yellowish red, medium acid sandy clay to a depth of 34 inches. Below that is brownish yellow, strongly cemented, acid sandstone.

Organic matter content is low. Permeability is moderately slow, and available water capacity is medium. A hard crust forms on the surface when the soil is dry. Tilth is poor, but the soil can be worked over a narrow range of moisture conditions. The root zone is moderately deep, and roots are restricted by the clayey lower layers. The hazards of water erosion and soil blowing are moderate.

Included with this soil in mapping are small areas of Owens and Truce soils on low knolls. Also included are a few small areas of a soil that is similar to Bonti soils except that sandstone bedrock is at a depth of less than 20 inches. These included soils are in areas of less than 10 acres and together make up less than 20 percent of any mapped area.

This soil is mainly used as rangeland. It has high potential for native range plants. The climax plant community is an open savannah of post oak and blackjack oak and an understory of mid and tall grasses. Management concerns include proper stocking, controlled grazing, and brush management.

This soil has medium potential for crops, such as forage sorghums, grain sorghum, and small grain. Terraces and contour cultivation helps control erosion. Crop residue left on the surface helps conserve moisture, resist crusting, and maintain productivity. Tillage should be timely and limited. Potential for pasture grasses is medium. Improved grasses, such as Kleingrass and King Ranch bluestem, are well suited to this soil.

This soil has medium potential for most urban uses. Depth to rock and the slower than optimum intake rate are limitations for septic tank absorption fields. Depth to rock is also a limitation for dwellings, and this limitation is difficult to overcome. Capability subclass IIe; Sandy Loam range site.

Bo—Bosque loam, occasionally flooded. This deep, well drained, nearly level, loamy soil is on the flood plains of major streams. Soil areas are long and narrow and range from 5 to 300 acres.

The surface layer is dark grayish brown, calcareous loam about 32 inches thick. The subsoil is brown, calcareous clay loam to a depth of 42 inches; pale brown, calcareous clay loam to a depth of 52 inches; and very pale brown, calcareous clay loam to a depth of 60 inches or more.

This is a productive soil. Organic matter content is high. Permeability is moderate, and available water capacity is high. The soil is flooded occasionally but only for short periods. It has good tilth and can be worked over a wide range of moisture conditions. The root zone is deep and easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas, less than 5 acres in size, of Frio, Lamkin, and Venus soils. Frio soils are usually in places where the flood plain broadens and along old alternate channels. Lamkin soils are on the edges of stream channels. Venus soils are in narrow bands where the flood plain meets the uplands. These included soils together make up less than 20 percent of any mapped area.

This soil is mostly used as cropland. It has high potential for crops, such as grain sorghum, cotton, small grain, forage sorghum, and alfalfa. It also has high potential for pecan trees. Crop residue left on the surface help conserve moisture and maintain tilth and productivity. Crops on this soil respond well to fertilization. Potential for pasture grasses is high. Improved grasses, such as bermudagrass and Kleingrass, are well suited to this soil.

This soil has high potential for native range plants. The climax plant community is a tall grass savannah and a 10- to 15-percent canopy of tall trees. The tall trees and an adequate food supply in the surrounding area provide habitat for turkey and squirrel. Management concerns include proper grazing use, which includes adequate rest periods, and brush management.

This soil has low potential for most urban uses. Flooding is the main limitation, and it can be overcome only by major flood control measures. Capability subclass IIw; Loamy Bottomland range site.

BrC—Brackett-Bolar complex, 1 to 5 percent slopes. This is a complex of gently sloping soils on convex, low knolls. Soil areas are usually oval and range from 5 to 100 acres.

About 67 percent of this complex is Brackett soils, about 16 percent is Bolar soils, and about 17 percent is other soils. Brackett soils dominate the complex, and the other soils are in patterns too intricately mixed and small to be delineated at the mapping scale used. Brackett soils are in oval areas near the centers of the mapped areas; Bolar soils and the other soils are at the outer fringes of mapped areas.

The Brackett soil has a surface layer of brown, calcareous gravelly clay loam about 4 inches thick. Fragments of limestone 1 to 3 inches in diameter make up about 20 percent of the surface layer. The subsoil is light yellowish brown, calcareous clay loam that contains many concretions and soft bodies of calcium carbonate and that extends to a depth of 18 inches. Below that is weakly cemented, platy limestone interbedded with thin layers of very pale brown, calcareous clay loam.

The Brackett soil is low in organic matter content. Permeability is moderately slow, and available water capacity is very low. The soil can be worked throughout a wide range of moisture conditions, but the gravelly surface layer restricts proper tillage. The root zone is restricted because of shallow depth over rock. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

The Bolar soil has a surface layer of dark brown, calcareous clay loam about 16 inches thick. The subsoil is pale brown, calcareous loam to a depth of 28 inches and very pale brown, calcareous loam to a depth of 38 inches. The lower layers contain many concretions of calcium carbonate. The underlying material, below a depth of 38 inches, is hard limestone interbedded with clayey marl.

The Bolar soil is high in organic matter content. It is a productive soil. Permeability is moderate, and available water capacity is medium. The soil has good tilth and can be worked over a wide range of moisture conditions. The root zone is moderately deep and easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with these soils in mapping are small areas, less than 5 acres in size, of Karnes soils. Also included are small areas, also of less than 5 acres, of a soil that is similar to Brackett soils except that limestone fragments make up more than 35 percent, by volume, of the soil. These included soils make up less than 20 percent of any mapped area.

This complex is mostly used as rangeland. It has medium potential for native range plants or wildlife habitat. The climax plant community is a mixture of tall, mid, and short grasses and scattered Texas oak and live oak. Management concerns include proper stocking, controlled grazing, and brush management.

This complex has low potential for crops. Small grain is the major crop where this soil is being farmed. Return of crop residue to the soil helps maintain productivity and tilth. Potential for pasture grasses is low. Restricted root zone, low available water capacity, and high lime content are difficult to overcome.

Potential for urban uses is low. Depth to rock and high corrosivity are limitations that affect urban use. Capability subclass IVe; Brackett soil in Adobe range site; Bolar soil in Clay Loam range site.

BsE—Brackett-Karnes complex, 1 to 12 percent slopes. This is a complex of gently sloping to strongly sloping soils on uplands. Limestone gravel is on the surface in most areas. Limestone fragments from 6 to 20 inches in diameter cover from 1 to 15 percent of the surface and are commonly in narrow bands on side slopes. This complex is in long, oval to irregularly shaped areas that range from 10 to 100 acres.

About 43 percent of this complex is Brackett soils, 30 percent is Karnes soils, and 27 percent is other soils. Brackett soils dominate the complex, and the other soils are in patterns too intricately mixed and small to be delineated at the mapping scale used. Karnes soils are in long, narrow bands on the lower parts of slopes or on foot slopes.

The Brackett soil has a surface layer of light yellowish brown, calcareous loam about 6 inches thick. Fragments of limestone less than 3 inches in diameter make up about 5 percent, by volume, of the surface layer. The subsoil is light yellowish brown, calcareous loam that contains numerous soft bodies and concretions of calcium carbonate and that extends to a depth of 16 inches. Below that is weakly cemented limestone that is interbedded with thin strata of olive yellow, calcareous loam and clay loam.

The Brackett soil is low in organic matter content and high in lime content. The high lime content affects the availability of some plant elements. Permeability is moderately slow, and available water capacity is very low. The root zone is restricted because of shallow depth to rock. The hazard of water erosion is severe, and the hazard of soil blowing is slight.

The Karnes soil has a surface layer of brown, calcareous loam about 10 inches thick. The subsoil is light yellowish brown, calcareous loam that contains common concretions and soft bodies of calcium carbonate. The underlying material, extending to a depth of 60 inches or more, is pale yellow, calcareous loam.

The Karnes soil is high in content of lime, which causes some plant elements to be held unavailable for plant use. Permeability is moderately rapid, and available water capacity is medium. The root zone is deep and easily penetrated by plant roots. The hazard of water erosion is severe, and the hazard of soil blowing is slight.

Included with these soils in mapping are small areas of Bolar and Venus soils and a soil that is similar to Brackett soils except that the lower layers are hard limestone. The soil that is similar to Brackett soils is gently sloping and is on the upper parts of slopes. Bolar and Venus soils are on the lower parts of slopes. The included soils make up less than 27 percent of any mapped area.

This complex is used as rangeland. It has medium potential for native range plants or wildlife habitat. The climax plant community is a mixture of tall, mid, and short grasses and scattered Texas oak and live oak. Management concerns include proper stocking, controlled grazing, and brush management.

This complex has low potential for farming. Stones on the surface and slope are difficult to overcome. Potential for pasture grasses is low.

Potential for urban uses is low. Depth to rock and high corrosivity are limitations that affect urban use. Capability subclass VIs; Brackett soil in Adobe range site, Karnes soil in Clay Loam range site.

BTF—Brackett soils, hilly. This map unit is made up of dominantly stony or very stony, strongly sloping to moderately steep soils on hillsides. Limestone fragments from 6 to 26 inches in diameter cover from 1 to 20 percent of the surface. The very stony areas are usually on the upper parts of slopes and the less stony areas are on the lower parts. Slope ranges from 8 to 20 percent and is dominantly about 15 percent. Soil areas are long and narrow and range from 20 to 150 acres.

Brackett stony soils are the dominant soils in this map unit. They make up nearly 60 percent of the unit. Soils that are similar to Brackett but that are underlain by hard limestone; Rock outcrop; soils that are very shallow over chalky material; and soils more than 20 inches deep make up the remainder of the unit. Proportions of these soils vary from one mapped area to another, and not all of the less extensive soils are in each mapped area.

The Brackett soils in this unit have a surface layer of brown, calcareous stony loam about 6 inches thick. The subsoil is pale brown, calcareous loam that extends to a depth of 16 inches. Below that are thin layers of strongly cemented limestone interbedded with white marly loam.

These soils are low in organic matter content. Permeability is moderately slow, and available water capacity is very low. The hazard of water erosion is severe, and the hazard of soil blowing is slight.

Included with these soils in mapping are small areas of Owens soils, which are on the southern exposures of hillsides. These included soils are less than 20 acres in size and make up less than 20 percent of any mapped area.

These soils are used mostly as rangeland. They have low potential for native range plants or wildlife habitat. The climax plant community is a mixture of mid and short grasses and scattered Texas oak. Management concerns include proper stocking, controlled grazing, and brush management.

Potential for crops and pasture grasses is low. Potential for urban uses is low. The stones, shallow depth to rock, and slope are limitations that affect these uses. The esthetic beauty of areas of these soils is appealing to some homebuilders, and extra financial expenditures are made to help overcome the limitations for building sites. Capability subclass VIIs; Steep Adobe range site.

ChC—Chaney loamy sand, 1 to 5 percent slopes. This deep, moderately well drained, gently sloping, sandy soil is in broad areas on uplands. These irregularly shaped areas range in size from 5 to 800 acres, but average about 40 acres.

The surface layer is pale brown, neutral loamy sand about 8 inches thick. The subsoil is yellowish red, slightly acid sandy clay to a depth of 20 inches; mottled red, yellowish red, and light brownish gray, slightly acid sandy clay to a depth of 36 inches; and mottled red, brownish yellow, and grayish brown, neutral sandy clay to a depth of 48 inches. The underlying material, extending to a depth of 62 inches or more, is reddish yellow, moderately alkaline sandy clay.

This soil is low in organic matter content. Permeability is slow, and available water capacity is medium. The soil is moderately well drained, and water accumulates above the clayey lower layers for short periods during periods of high rainfall. The root zone is deep, but the clayey lower layers restrict penetration of some roots. The hazard of soil blowing is severe, and the hazard of water erosion is moderate.

Included with this soil in mapping are small areas, less than 5 acres in size, of Demona, Hassee, and Pedernales soils. Demona soils are in the lower concave positions. Hassee soils are in oval, depressional, or ponded areas. Pedernales soils are on the higher convex knolls or ridges. These included soils together make up less than 20 percent of any mapped area.

This soil is used mainly as cropland. Potential for peanuts and truck crops is high. Potential for grain sorghum, forage sorghum, pecan trees, and fruit trees is medium. Crop residue left on the surface helps conserve moisture, slow runoff, reduce soil blowing, and maintain productivity. Wind stripcropping and cover cropping help control blowing. Crops on this soil respond well to fertilization. Potential for pasture grasses is high. Improved grasses, such as Coastal bermudagrass and lovegrass, are well suited to this soil.

This soil has medium potential for native range plants. The climax plant community is a mixture of tall and mid grasses and a partial canopy of post oak trees. Management concerns include proper stocking, controlled grazing, and brush management.

Potential for most urban uses is medium. Shrink-swell potential and low strength are limitations, but they can be overcome by good design and careful installation procedures. The sandy clay lower layers take in water more slowly than the optimum rate for septic tank filter fields, but this can be overcome by increasing the size of the absorption field or by modifying the filter field. Capability subclass IIIe; Loamy Sand range site.

ChC2—Chaney loamy sand, 1 to 5 percent slopes, eroded. This deep, moderately well drained, gently sloping, sandy soil is on uplands and has a plane to convex surface. Areas are irregularly shaped and range from 10 to 100 acres but are dominantly about 30 acres. Soil blowing and water erosion have thinned the surface layer to less than 6 inches. A few areas of rill erosion are near the breaks of convex slopes.

The surface layer is brown, slightly acid loamy sand about 3 inches thick. The subsoil is yellowish red, slightly acid sandy clay to a depth of 17 inches; mottled red, gray, brownish yellow, and yellowish red sandy clay to a depth of 32 inches; gray sandy clay that extends to a depth of 42 inches. The underlying material, extending to a depth of 60 inches or more, is light brownish gray shaly clay.

This soil is low in organic matter content. Permeability is slow, and available water capacity is medium. The root zone is deep, but the clayey lower layers restrict root penetration. The soil blowing and water erosion hazards are severe.

Included with this soil in mapping are small areas of Pedernales soils, which are usually on the upper parts of convex slopes. Also included are a few small galled spots, or areas where the sandy clay lower layers have been mixed with the loamy sand surface layer to produce a surface layer that ranges in texture from loamy sand to fine sandy loam. The included soils are less than 5 acres in size and make up less than 20 percent of any mapped area.

This soil is mostly used as cropland. Potential for peanuts, sorghums, and truck crops is low. Crop residue left on the surface helps conserve moisture, slow runoff, reduce soil blowing, and hold down soil temperature. Other practices, such as cover cropping, wind stripcropping, terracing, and rotation of hay and pasture, are also needed. Crops on this soil respond well to fertilization. Potential for pasture grasses is medium. Improved pasture grasses such as Coastal bermudagrass and lovegrass are well suited to this soil.

Potential for native range plants is high. Erosion has thinned the original surface layer and destroyed most of the climax plant community. Range seeding is occasionally required to introduce climax species back to the plant community. Management concerns include proper stocking, controlled grazing, and brush management.

Potential for most urban uses is medium. Shrink-swell potential, slow water intake, and low strength can be overcome by good design and proper installation procedures. The sandy clay lower layers take in water more slowly than the optimum rate for septic tank filter fields, but this can be overcome by increasing the size of the absorption field or by modifying the filter field. Capability subclass IIIe; Loamy Sand range site.

ChD—Chaney loamy sand, 5 to 8 percent slopes. This deep, moderately well drained, sloping, sandy soil is on uplands. Areas are usually long and narrow and extend along the slope into drainageways. Areas range from 5 to 50 acres.

The surface layer is slightly acid loamy sand about 10 inches thick. The upper 6 inches is grayish brown, and the lower 4 inches is very pale brown. The subsoil is red, slightly acid sandy clay that has distinct mottles of grayish brown and yellowish red to a depth of 20 inches; yellowish red, neutral sandy clay that has mottles of grayish brown and red to a depth of 34 inches; and brownish yellow, neutral sandy clay that is mottled in shades of grayish brown and reddish yellow and that extends to a depth of 46 inches. The underlying material is hard conglomerate sandstone interbedded with massive sandy clay loam.

This soil is low in organic matter content. Permeability is slow, and available water capacity is medium. The soil is moderately well drained, and water accumulates above the clayey lower layers for short periods following heavy rains. The root zone is deep, but the clayey lower layers restrict some root penetration. The soil blowing and water erosion hazards are severe.

Included with these soils in mapping are small areas of Pedernales, Owens, Bastrop, Truce, and Brackett soils. Brackett and Owens soils are in small areas on the upper parts of slopes; in places a few limestone fragments are on the surface of these soils. Truce soils are in small, narrow strips near the upper parts of slopes, and in places they have a few sandstone fragments on the surface. Pedernales soils are in similar positions as Chaney soils, but are in a random pattern. Bastrop soils are in the lower parts of slopes, usually adjacent to flood plains.

Each area of these included soils is less than 15 acres; together the included soils make up less than 20 percent of any mapped area.

This soil is mainly used as pasture. Potential for pasture grasses is medium. Grasses such as bermudagrass and lovegrass are well suited to this soil. Potential for crops is low. Erosion is a hazard because of slope; in cultivated areas erosion is difficult to overcome. Crops on this soil respond well to fertilization.

Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses and an overstory of oak trees.

Potential for most urban uses is medium. Shrink-swell potential, low strength, and slow water intake are limitations that can be overcome by good design and careful installation procedures. Capability subclass IVe; Loamy Sand range site.

CmD—Chaney stony loamy sand, 1 to 8 percent slopes. This deep, moderately well drained, gently sloping to sloping sandy soil is on convex stony knolls and ridges. Areas are irregularly shaped to oval and range from 10 to 250 acres; they average about 50 acres. Loose conglomerate sandstone covers from 5 to 20 percent of the surface, but ranges from 6 to 75 inches in diameter (fig. 5). The stones are imbedded in the surface layer; they make up only about 1 percent, by volume, of the lower layers.

The surface layer is slightly acid stony loamy sand about 12 inches thick. The upper 6 inches is brown, and the lower 6 inches is very pale brown. About 15 percent of the surface is covered with conglomerate sandstone 6 to 36 inches in diameter. The subsoil is yellowish red, mottled, neutral sandy clay to a depth of 20 inches; coarsely mottled yellowish red, light brownish gray, and brownish yellow, neutral sandy clay to a depth of 36 inches; and brownish yellow, neutral sandy clay that is mottled with gray and that extends to a depth of 44 inches. The underlying material, extending to a depth of 62 inches, is brownish yellow, moderately alkaline shaly clay.

Permeability is slow, and available water capacity is medium. The root zone is deep, but the clayey lower layers restrict the penetration of plant roots in some places. The hazard of soil blowing is severe, and the hazard of water erosion is moderate.

Included with this soil in mapping are small areas, less than 5 acres in size, of Demona and Pedernales soils. Demona soils are on the lower parts of slopes, and Pedernales soils are on the upper parts. These included soils together make up less than 20 percent of any mapped area.

This soil is used as rangeland. The potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses and an overstory of oak trees. Management concerns include controlled grazing, proper stocking, and brush management. The potential for wildlife habitat is medium.

The potential of the soil as cropland, for pasture, and for urban uses is low. The large stones on the surface are a limitation that is difficult to overcome. Capability subclass VIs; Loamy Sand range site.

CnD3—Chaney soils, 1 to 8 percent slopes, severely eroded. These deep, moderately well drained, gently sloping to sloping soils are on uplands. Areas are irregularly shaped or are fingerlike projections from drainageways. They range from 5 to 50 acres. Water erosion has formed gullies 5 feet deep, 7 feet wide, and about 40 feet apart. Erosion between the gullies has been slight to moderate; the surface layer in such areas varies from loamy sand or sandy loam to sandy clay loam. These soils are not uniform and are in a random pattern on the landscape.

In a representative profile the surface layer is brown, slightly acid loamy sand about 4 inches thick. The upper part of the subsoil is reddish yellow, slightly acid sandy clay that has gray, red, and yellow mottles and that extends to a depth of 32 inches. The lower part is brownish yellow, mottled, slightly acid sandy clay that extends to a depth of 40 inches. The underlying material, extending to a depth of 60 inches or more, is light brownish gray shaly clay.

These soils are low in organic matter content. Permeability is slow, and available water capacity is medium. The root zone is deep, but the clayey lower layers restrict some root penetration. The hazards of water erosion and soil blowing are severe.

Included with these soils in mapping are small areas of Pedernales soils on the upper parts of slopes. Areas of these included soils are less than 5 acres and make up less than 15 percent of any mapped area.

These soils are used as rangeland. The potential for native range plants is medium. The climax plant community is a mixture of tall and mid grasses and an overstory of oak trees, but erosion has destroyed most of the vegetation in places. In such areas range seeding was necessary to reintroduce the climax vegetation. Proper grazing use, which includes adequate rest periods, and brush management are required.

Potential for crops or pasture grasses is low. Shaping and smoothing of the gullies, fertilizing, and seeding or sprigging improved pasture grasses can convert this soil to pasture. Careful management is required to prevent additional erosion. Major reclamation, which would require many cuts and fills, is necessary if these soils are ever to be cultivated.

Potential for most urban uses is low. The gullies, slow intake rate, and low strength require special treatment. Capability subclass VIe; Loamy Sand range site.

CoC—Cisco loamy fine sand, 1 to 5 percent slopes. This deep, well drained, gently sloping, sandy soil is in broad valleys on uplands. Soil areas are irregularly shaped and range from 20 to 100 acres. Slopes are plane to slightly concave and average about 2 percent.

The surface layer is dark grayish brown, neutral loamy fine sand about 4 inches. The subsurface layer is light brown, neutral loamy fine sand that extends to a depth of

10 inches. The subsoil is yellowish red, neutral sandy clay loam to a depth of 26 inches and reddish yellow, faintly mottled, neutral sandy clay loam to a depth of 50 inches. The underlying material, extending to a depth of 70 inches or more, is white, calcareous sandy clay loam.

Permeability is moderate, and available water capacity is high. The soil has good tilth and can be worked well over a wide range of moisture conditions. The root zone is deep and easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is severe.

Included with this soil in mapping are small areas of Chaney, May, Menard, and Pedernales soils. Chaney and May soils are usually on the lower parts of slopes. Menard and Pedernales soils are on low knolls. Areas of these included soils are less than 15 acres and together make up less than 15 percent of any mapped area. Also included are a few small areas of a soil that is similar to Cisco soils except that the sandy clay loam lower layer uniformly extends to a depth of more than 60 inches.

This soil is mainly used as cropland. Potential for peanuts and forage sorghum is high. Potential for grain sorghum is medium. Such practices as crop residue management, cover cropping, and wind stripcropping help control soil blowing, conserve moisture, and maintain productivity. Crops on this soil respond well to fertilization. This soil is well suited to fruit and nut orchards. Potential for pasture grasses is high; bermudagrass and lovegrass are well suited to the soil.

Potential for native range plants is high. The climax plant community consists of tall and mid grasses and an overstory of oak trees. Management concerns include proper stocking and brush management.

This soil has high potential for most urban uses. Shrink-swell potential and low strength are limitations, but they can be easily overcome by good design and proper installation procedures. Capability subclass IIIe; Loamy Sand range site.

Dc—Deleon clay, occasionally flooded. This deep, moderately well drained, nearly level, clayey soil is on flood plains. It is in bands, 50 to 600 yards wide, that parallel streams (fig. 6). Soil areas range from 40 to 400 acres. These soils are slightly higher and are flooded less often than Deleon clay, frequently flooded.

The upper part of the surface layer is dark grayish brown, calcareous clay 6 inches thick. Below this is very dark grayish brown and dark grayish brown, calcareous to a depth of 48 inches; and brown, calcareous clay that extends to a depth of 62 inches or more.

This productive soil is high in organic matter content. Permeability is slow, and available water capacity is high. The soil has poor tilth and can be worked only in a narrow range of moisture conditions. The root zone is deep. The clay lower layers restrict the growth of some plant roots. The soil is flooded occasionally, but only for short periods. The erosion hazard is slight.

Included with this soil in mapping are small areas of Lamkin and Energy soils. These soils are in narrow strips near the lip, or natural levee, of the stream channel. Included soils make up less than 20 percent of any mapped area.

This soil is mostly used as cropland. Potential for crops, such as grain sorghum, small grain, and alfalfa, is high. Potential is also high for peach orchards. Crop residue left on the surface helps conserve moisture, reduce soil temperature, and maintain soil tilth and productivity. Potential is high for pasture grasses; bermudagrass and Kleingrass are well suited to the soil.

This soil has high potential for native range plants. The climax plant community is a mixture of tall and mid grasses, forbs, and trees. Management concerns include proper stocking, controlled grazing, and brush management. The climax plant community provides excellent habitat for wild turkey.

This soil has low potential for most urban uses. Flooding is the main limitation, and it is very difficult to overcome. Capability subclass IIIw; Clayey Bottomland range site.

De—Deleon clay, frequently flooded. This deep, moderately well drained, nearly level soil is on flood plains. It is in bands, 50 to 300 feet wide, that parallel streams. Areas range from 50 to 500 acres.

The upper part of the surface layer is dark grayish brown, calcareous clay about 10 inches thick. Below this is very dark grayish brown and dark grayish brown, calcareous clay to a depth of 50 inches. The underlying material, extending to a depth of 60 inches or more, is brown, calcareous clay.

This productive soil is high in organic matter content. Permeability is slow, and available water capacity is high. The soil has poor tilth and can be worked well only in a narrow range of moisture conditions. The root zone is deep, but the clayey lower layers restrict the growth of some plant roots. Flooding occurs on an average of once or more every 2 years. The soil is flooded frequently and for brief periods, mostly in the period February through May. A water table is within 10 feet of the surface in most years. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas, less than 5 acres in size, of Energy and Lamkin soils. They are along the edges of stream channels and make up less than 20 percent of any mapped area.

This soil is mostly used as pasture. It has high potential for pasture grasses. Improved grasses, such as bermudagrass and Kleingrass, are well suited to this soil, and pecan orchards are also grown in combination with pasture. Because of flooding, potential for crops is low. Flooding can be overcome only by major flood-control measures.

Potential for native range plants and for development of habitat for squirrel and turkey is high. The climax plant community is a mixture of tall and mid grasses, forbs, and trees. Management concerns include proper stocking, controlled grazing, and brush management.

This soil has low potential for most urban uses. Flooding is the main limitation; it can be overcome only by major flood-control measures. Capability subclass Vw; Clayey Bottomland range site.

DmC—Demona loamy sand, 0 to 5 percent slopes. This deep, moderately well drained, nearly level to gently sloping, sandy soil is on uplands. These irregularly shaped areas range from 10 to 200 acres.

The surface layer is about 10 inches thick. The upper 6 inches is light yellowish brown, neutral loamy sand, and the next 4 inches is brown, neutral loamy sand. The subsurface layer is light brown, neutral loamy sand that extends to a depth of 36 inches. The subsoil is brownish yellow, medium acid sandy clay mottled with red and gray to a depth of 52 inches; red, medium acid sandy clay mottled with gray and yellow to a depth of 60 inches; and light red, slightly acid sandy clay loam that extends to a depth of 74 inches or more.

Permeability is moderately slow, and available water capacity is medium. The hazard of soil blowing is severe (fig. 7), and the hazard of water erosion is moderate. During wet seasons, water accumulates above the sandy clay lower layers for short periods. The root zone is deep, but some plant roots are restricted by the clayey lower layers.

Included with this soil in mapping are small areas, less than 5 acres in size, of Chaney, Hassee, and Nimrod soils. Chaney soils usually are on slight knolls, and Hassee soils are in depressional areas. Nimrod soils are in similar positions as Demona soils, but are in a random pattern on the landscape. These included soils make up less than 20 percent of any mapped area; any one soil makes up less than 15 percent.

This soil is mostly used as cropland. Potential is high for such crops as peanuts and truck crops and medium for grain sorghum. This soil is well suited to pecans, pears, and apples. Crop residue left on the surface helps conserve moisture, reduce soil temperature, and control soil blowing. Other practices, such as cover cropping, wind stripcropping, and rotation of hay and pasture, help control soil blowing and maintain productivity. Crops on this soil respond well to frequent applications of fertilizer. Potential for pasture grasses is high; grasses, such as bermudagrass and lovegrass, are well suited to this soil.

This soil has high potential for native range plants. The climax plant community is a post oak and blackjack oak savannah. Tall grasses and some mid grasses make up the understory. The major management concerns include proper stocking, controlled grazing, and brush management.

This soil has medium potential for most urban uses. Seasonal wetness is a concern, and it can be overcome only through use of proper drainage measures. Capability subclass IIIe; Sandy range site.

DnB—Denton silty clay, 1 to 3 percent slopes. This moderately deep, well drained, gently sloping, clayey soil is in broad areas on uplands. Soil areas are irregularly shaped and range from 10 to 200 acres. Slopes are plane to slightly concave.

The surface layer is very dark grayish brown, calcareous silty clay about 12 inches thick over dark brown, calcareous silty clay that extends to a depth of 24 inches. The subsoil is light brown, calcareous silty clay that extends to a depth of 30 inches. The underlying material is very pale brown, marly clay loam that extends to a depth of 36 inches. It has an abrupt boundary, and it overlies hard, white, fractured limestone.

This soil is high in organic matter content. It is a productive soil. Permeability is slow, and available water capacity is medium. The soil has poor tilth and can be worked well only in a narrow range of moisture conditions. When wet, the soil is very sticky and plastic, and when dry, it has deep cracks at the surface. The root zone is restricted by the moderate depth to rock. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Bolar, Krum, and Purves soils. Bolar soils are on the lower parts of convex slopes. The deep Krum soils are along drainageways or in shallow, filled valleys. The shallow Purves soils are on the upper parts of slopes. These included soils together make up less than 20 percent of any mapped area; any one soil makes up less than 15 percent.

This soil is used mostly as rangeland. Potential for native range plants is high. The climax plant community is an open prairie supporting an abundant growth of mid and tall grasses. Woody plants are not significant in the climax vegetation. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential for row crops, such as sorghums, cotton, and small grain, is high. Terraces and contour cultivation help control erosion. Crop residue left on the surface helps conserve moisture, slow runoff, reduce soil temperature, and maintain soil tilth and productivity. Potential is high for pasture grasses. Such grasses as bermudagrass, Kleingrass, and King Ranch bluestem are suited to this soil.

This soil has medium potential for most urban uses. Shrink-swell potential, depth to rock, slow water intake, and low strength are limitations that must be overcome in design or modification of the soil. Capability subclass IIe; Clay Loam range site.

DnC—Denton silty clay, 3 to 5 percent slopes. This moderately deep, well drained, gently sloping, clayey soil is on uplands. Soil areas are irregularly shaped and range from 10 to 100 acres.

The surface layer is dark grayish brown, calcareous silty clay about 24 inches thick. The subsoil is yellowish brown, calcareous silty clay that extends to a depth of 34 inches. The underlying material is light yellowish brown silty clay about 4 inches thick. Concretions of calcium carbonate make up about 20 percent, by volume, of the underlying material. The underlying material has an abrupt boundary and rests on hard limestone.

This soil is high in organic matter content. It is a productive soil. Permeability is slow, and available water capacity is medium. The soil has poor tilth and can be worked only in a narrow range of moisture conditions. When wet, this soil is very sticky and plastic, and when dry, it has deep cracks at the surface. The root zone is restricted by the moderate depth to rock. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Bolar, Krum, and Purves soils. Bolar soils typically are on the lower parts of slopes, Krum soils are along drainageways, and Purves soils are on low knolls. Areas of these included soils are less than 20 acres, and together they make up less than 20 percent of any mapped area.

This soil is used mostly as rangeland. Potential for native range plants is high. The climax plant community is an open prairie supporting an abundant growth of mid and tall grasses. Woody plants are not significant in the climax vegetation. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential for such crops as grain sorghum, cotton, and small grains is high. Terraces and contour cultivation help control erosion. Crop residue left on the surface helps conserve moisture, slow runoff, reduce soil temperature, and maintain soil productivity and tilth. Potential for pasture grasses is medium. Grasses, such as bermudagrass, Kleingrass, and King Ranch bluestem, are suited to this soil.

Potential for most urban uses is medium. Shrink-swell potential, depth to rock, slow water intake, and low strength are limitations that must be overcome in design or modification of the soil. Capability subclass IIIe; Clay Loam range site.

Ee—Energy fine sandy loam, occasionally flooded. This deep, well drained, nearly level, loamy soil is on flood plains. This soil is newer sediments in long, narrow areas near the stream channel. The soil areas range from 20 to 100 acres. The stream channel is of sufficient depth and capacity to prevent all but occasional flooding.

The surface layer is light yellowish brown, calcareous fine sandy loam about 8 inches thick. The underlying material, extending to a depth of 60 inches or more, is layered alluvial, calcareous material. It is brown clay loam to a depth of 20 inches, grayish brown sandy clay loam to a depth of 30 inches, pale brown sandy loam to a depth of 42 inches, brown clay loam to a depth of 50 inches, and very dark grayish brown sandy clay loam below.

This soil is productive. Permeability is moderate, and available water capacity is medium. The soil has good tilth and can be worked during a wide range of moisture conditions. The root zone is deep and easily penetrated by plant roots. The soil is flooded occasionally, but flooding usually lasts for only a few hours. The hazard of soil blowing is moderate, and the hazard of water erosion is slight.

Included with this soil in mapping are small areas of Deleon or Lamkin soils, usually in areas where the flood plain broadens. Areas of these included soils are less than 10 acres and together make up less than 20 percent of any mapped area.

This soil is mostly used as pasture. Potential for pasture grasses is high; bermudagrass is well suited to this soil. Pecan orchards are also well suited. Potential for crops is high and is limited mainly by the size and location of soil areas and by occasional damaging floods. Forage sorghum is the main crop grown on this soil. Crop residue left on the surface helps conserve moisture and maintain soil productivity and tilth.

Potential for native range plants is high. The climax plant community is a tall grass savannah and a 10- to 15-percent canopy of tall trees. The trees are mainly native pecan. Turkey and squirrel frequent these areas. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential is low for most urban uses. Occasional flooding can be overcome only by major flood-control measures. Capability subclass IIw; Loamy Bottomland range site.

Ef—Energy soils, frequently flooded. These deep, well drained, nearly level soils are on flood plains. Areas are irregularly shaped to long and narrow. They consist of newer sediments near the stream channels. Areas range from 20 to 400 acres. The surface layer of the soils is variable in texture, ranging from fine sandy loam to sandy clay loam. The soils are in a random pattern on the landscape. In some areas near the stream channels, they are gently undulating.

The surface layer is light yellowish brown, calcareous fine sandy loam about 8 inches thick. The underlying material is brown clay loam to a depth of 28 inches, brown sandy clay loam to a depth of 38 inches, very pale brown loamy sand to a depth of 44 inches, and brown sandy clay loam that extends to a depth of 62 inches or more.

These soils are productive. Permeability is moderate, and available water capacity is medium. The soils have good tilth and can be worked over a wide range of moisture conditions. The root zone is deep and easily penetrated by plant roots. The soils are flooded frequently, but only for short periods. The hazards of soil blowing and water erosion are moderate.

Included with these soils in mapping are small areas of Deleon or Lamkin soils. These included soils are usually in areas where the flood plain broadens. They are usually in areas of less than 15 acres and together make up less than 20 percent of any mapped area.

These soils are mostly used as pasture. Potential for pasture grasses is high. Bermudagrass is well suited to this soil. Pecan orchards are also well suited. Potential as cropland and for most urban uses is low because of frequently damaging floods.

Potential for native range plants is high. The climax plant community is a tall grass savannah with a 10- to 15-percent canopy of tall trees. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management. Capability subclass Vw; Loamy Bottomland range site.

Fr—Frio clay loam, occasionally flooded. This deep, well drained, nearly level, loamy soil is in broad areas on bottom lands. Slope is less than 1 percent. Areas are oblong bands along flood plains of streams and range from 10 to 500 acres.

The surface layer is dark grayish brown, calcareous clay loam to a depth of 6 inches; very dark grayish brown, calcareous silty clay to a depth of 18 inches; dark grayish brown, calcareous silty clay to a depth of 36 inches; and grayish brown, calcareous silty clay to a depth of 50 inches. The underlying material, extending to a depth of 62 inches or more, is very pale brown, calcareous clay loam.

This soil is productive. Organic matter content is high. Permeability is moderately slow, and available water capacity is high. The soil is flooded occasionally during periods of high rainfall. The root zone is deep and easily penetrated by plant roots. Tilth is good, and this soil can be worked during a wide range of moisture conditions. The soil is very sticky and plastic when wet. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas, less than 5 acres in size, of Bosque, Deleon, and Lamkin soils. Bosque and Lamkin soils are near the stream channel, and Deleon soils are along old channel areas or sloughs. These included soils make up less than 20 percent of any mapped area.

This soil is used mostly as cropland. Potential for such crops as sorghum, corn, cotton, alfalfa, and small grain is high. Crop residue left on the surface helps conserve moisture and maintain tilth and productivity. Potential for pasture grasses is high; grasses, such as bermudagrass, Kleingrass, and lovegrass, are well suited to this soil.

Potential for native range plants is high. The climax plant community is a tall grass savannah and a 10- to 15-percent canopy of tall trees. Major management concerns include proper grazing use, which includes adequate rest periods, and brush management. The soils provide habitat for deer, turkey, and squirrel.

Potential for most urban uses is low. Flooding is difficult to overcome without major flood-control measures. Capability subclass IIw; Loamy Bottomland range site.

HaA—Hassee loam, 0 to 1 percent slopes. This deep, somewhat poorly drained, nearly level, loamy soil is in oval to oblong depressional areas. The surface is mostly concave. Areas range from 5 to 30 acres.

The surface layer is dark grayish brown, neutral loam about 10 inches thick. The subsurface layer is light gray, neutral loam that extends to a depth of 14 inches. The subsoil is dark gray, neutral clay to a depth of 38 inches and gray, calcareous clay to a depth of 50 inches. The underlying material, extending to a depth of 60 inches or more, is light brownish gray, calcareous clay.

This soil is very slowly permeable. Available water capacity is medium. The concave areas receive runoff from higher areas, and the surface is ponded after rainfall. When dry, the soil has a hard crust on the surface. It has poor tilth and can be worked only in a narrow range of moisture conditions. It has a deep root zone, but the blocky clay lower layers severely restrict plant root penetration. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of May and Thurber soils. May soils are on the upper parts of side slopes. Thurber soils have plane slopes. Areas of these included soils are less than 5 acres in size and together make up less than 20 percent of any mapped area.

This soil is mostly used as rangeland. Potential for native range plants is medium. The climax plant community is an open prairie of mid and short grasses. Condalia and ephedra are scattered throughout the area. Management concerns include proper grazing use, which includes adequate rest periods.

Potential for most summer crops is low; however, potential for cool-season crops, such as oats, and crops that make efficient use of soil moisture, such as sorghum, is medium. Crop residue left on the surface helps conserve moisture and maintain tilth. Potential for pasture grasses is medium; King Ranch bluestem is suited to this soil.

Potential for most urban uses is low. Wetness, very slow water intake, and shrink-swell potential are very difficult to overcome. Capability subclass IIIw; Claypan Prairie range site.

HaB—Hassee loam, 1 to 3 percent slopes. This deep, somewhat poorly drained, gently sloping, loamy soil is in oval to oblong, depressional areas. The surface is plane to concave. Areas range from 5 to 100 acres.

The surface layer is dark grayish brown, slightly acid loam about 8 inches thick. The subsurface layer is light brownish gray, slightly acid loam that extends to a depth of 12 inches. The subsoil is dark gray, slightly acid clay to a depth of 34 inches and gray, neutral clay to a depth of 42 inches. The underlying material, extending to a depth of about 60 inches or more, is light brownish gray, calcareous clay loam.

This soil is very slowly permeable. Available water capacity is medium. Because the soil is somewhat poorly drained, water occasionally ponds on the surface after rainfall. When dry, the soil has a hard crust on the surface. It has poor tilth and can be worked only in a narrow range of moisture conditions. It has a deep root zone, but the blocky clay lower layers severely restrict plant root penetration. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Thurber soils. Thurber soils are in positions similar to those of Hassee soils, but are in a random pattern on the landscape. Areas of these included soils are less than 10 acres and make up less than 20 percent of any mapped area.

This soil is mostly used as rangeland. Potential for native range plants is medium. The climax plant community is an open prairie of mid and short grasses. Condalia and ephedra are scattered throughout the community.

Management concerns include proper grazing use, which includes rest periods, and brush management.

Potential for most summer crops is low; however, potential for cool-season crops, such as oats, and crops that make efficient use of soil moisture, such as sorghum, is medium. Terraces and contour cultivation help control erosion. Crop residue left on the surface helps conserve moisture, reduce runoff, and maintain tilth. Potential for pasture grasses is medium; King Ranch bluestem is adapted to this soil.

Potential for most urban uses is low. Wetness, very slow water intake, and shrink-swell potential are very difficult to overcome. Capability subclass IIIe; Claypan Prairie range site.

HdC—Heaton loamy fine sand, 0 to 5 percent slopes. This deep, well drained, nearly level to gently sloping, sandy soil is on uplands. Soil areas are irregularly shaped and range from 15 to 150 acres.

The surface layer is yellowish brown, neutral loamy fine sand about 8 inches thick. The subsurface layer is brown, slightly acid loamy fine sand that extends to a depth of 34 inches. The subsoil is red, slightly acid sandy clay loam to a depth of 68 inches and reddish yellow, slightly acid fine sandy loam that extends to a depth of 80 inches or more.

Permeability is moderate, and available water capacity is medium. The root zone is deep and easily penetrated by plant roots. The hazard of soil blowing is severe, and the hazard of water erosion is moderate.

Included with this soil in mapping are small areas of Bastrop, Nimrod, and Patilo soils. Bastrop soils are in narrow bands on terraces near the slope that is adjacent to flood plains. Nimrod and Patilo soils are on slightly higher knolls. Areas of these included soils are less than 20 acres and together make up less than 20 percent of any mapped area.

This soil is used mainly as cropland. Potential for such crops as peanuts and truck crops is high. Potential for grain sorghum is medium. This soil is well suited to fruit trees and pecan trees. Returning crop residue to the soil, cover cropping, and wind stripcropping reduce soil blowing and maintain productivity. Supplemental irrigation is used in some areas. Crops on this soil respond well to fertilization. Potential for pasture grasses is medium; improved bermudagrass and lovegrass are well suited to this soil.

Potential for native range plants is high. The climax plant community is a savannah of post oak and blackjack oak and an understory of tall and mid grasses. Major management concerns include proper grazing use, which includes adequate rest periods, and brush management.

Potential for most urban uses is high. Capability subclass IIIe; Sandy range site.

HeB—Hensley loam, 1 to 3 percent slopes. This shallow, well drained, gently sloping, loamy soil is on uplands. Areas are oval to irregularly shaped and range from 10 to 60 acres.

The surface layer is brown, neutral loam about 5 inches thick. The subsoil is red, neutral clay that extends to a depth of 18 inches. Below that is hard limestone.

This soil is slowly permeable and has very low available water capacity. The root zone is shallow over rock. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Hensley stony loam. Also included are small areas of a soil that is similar to Hensley soils except that limestone bedrock is at a depth of 21 to 26 inches. These included soils make up less than 15 percent of any mapped area.

This soil is used as rangeland. Potential for native range plants is medium. The climax plant community is a mixture of tall and mid grasses and live oak trees. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential as cropland is low. The shallow root zone and very low available water capacity limit the crops that can be grown mainly to small grain. Potential for pasture grasses is low; Kleingrass and King Ranch bluestem are adapted to this soil.

Potential for most urban uses is medium; however, shallow depth to bedrock is a concern where excavation is required for the installation of structures or utilities. Capability subclass IIIe; Redland range site.

HnB—Hensley stony loam, 0 to 3 percent slopes. This shallow, well drained, nearly level to gently sloping, loamy soil is on stony hilltops. Areas range from about 30 to 200 acres. Hard, flat fragments of limestone 6 to 30 inches in diameter cover from 2 to 40 percent of the surface.

The surface layer is reddish brown, neutral stony loam about 5 inches thick. Flat fragments of limestone, 6 to 30 inches across the long axis, make up about 2 percent of the surface layer and cover about 5 percent of the surface. The subsoil is red, neutral clay that extends to a depth of 18 inches. Below this is limestone bedrock.

This soil is slowly permeable and has very low available water capacity. The root zone is shallow over rock. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Hensley loam. Also included are small areas of a soil that is similar to Hensley soils but that has a browner lower layer. These included soils make up less than 15 percent of any mapped area.

This soil is used as rangeland. Potential for native range plants is medium. The climax plant community is a mixture of tall and mid grasses, forbs, and live oak trees. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management. Potential for wildlife habitat is high.

Potential for crops and pasture grasses is low. Depth to rock and stones on the surface are limitations that are very difficult to overcome.

Potential for most urban uses is medium; however, shallow depth to rock is a concern where excavation is required for the installation of structures or utilities. Capability subclass VIs; Redland range site.

KaC—Karnes loam, 1 to 5 percent slopes. This deep, well drained, gently sloping, loamy soil is along major stream terraces. Areas are normally less than 20 acres.

The surface layer is pale brown, calcareous loam about 8 inches thick. The subsoil is very pale brown, calcareous sandy loam to a depth of 40 inches and very pale brown, calcareous fine sandy loam to a depth of 48 inches. The underlying material, extending to a depth of 62 inches or more, is very pale brown, calcareous fine sandy loam.

Permeability is moderately rapid, and available water capacity is medium. This soil has good tilth and can be worked during a wide range of moisture conditions. The root zone is deep and easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Brackett soils, usually on the upper parts of slopes or knolls. Areas are less than 3 acres and make up less than 20 percent of any mapped area.

This soil is mostly used as rangeland. Potential for native range plants is medium. The climax plant community is an open prairie supporting an abundant growth of mid and tall grasses. Major management concerns include proper grazing use, which includes adequate rest periods, and brush management.

Potential for such crops as grain sorghum or peanuts is low. The soil has medium potential for small grains. The high lime content causes chlorosis in some crops. Terraces and contour cultivation help control erosion. Crop residue left on the surface helps reduce runoff, conserve moisture, and maintain productivity. Potential for pasture grasses is low; grasses, such as Coastal bermudagrass and Kleingrass, are suited to this soil.

Potential for most urban uses is high. Capability subclass IIIe; Clay Loam range site.

KaD—Karnes loam, 5 to 8 percent slopes. This deep, well drained, sloping, loamy soil is on stream terraces and foot slopes. Areas are irregularly shaped and range from 10 to 50 acres.

The surface layer is grayish brown, calcareous loam about 8 inches thick. The subsoil is brown, calcareous loam to a depth of 38 inches and light yellowish brown, calcareous loam to a depth of 50 inches. The underlying material, extending to a depth of 60 inches or more, is very pale brown, calcareous sandy loam.

Permeability is moderately rapid, and available water capacity is medium. This soil has good tilth and can be worked through a wide range of moisture conditions. The root zone is deep and easily penetrated by plant roots. The hazard of water erosion is severe, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas, less than 5 acres in size, of Bosque and Venus soils. These included soils are along the lower parts of slopes or drainageways. They make up less than 20 percent of any mapped area.

This soil is mainly used as rangeland. Potential for native range plants is medium. The climax plant community is an open prairie supporting an abundant growth of mid and tall grasses. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential for most crops and pasture grasses is low. The slope and high lime content of this soil make it better suited to rangeland than to other uses.

Potential for most urban uses is high. Slope and corrosivity to uncoated steel can be overcome by proper design and careful installation procedures. Capability subclass IVe; Clay Loam range site.

KcA—Krum silty clay, 0 to 1 percent slopes. This deep, well drained, nearly level, clayey soil is in valleys. Soil areas are irregularly shaped to oval and range from 20 to 100 acres.

The surface layer is calcareous silty clay about 32 inches thick. The upper 8 inches is very dark grayish brown, and the lower 24 inches is dark grayish brown. The subsoil is brown, calcareous clay that extends to a depth of 46 inches. The underlying material, extending to a depth of 64 inches or more, is pale brown, calcareous clay loam.

This soil is productive. Organic matter content is high. Permeability is moderately slow, and available water capacity is high. Tilth is poor, and the soil can be worked in a narrow range of moisture conditions. When wet, the soil is sticky and plastic, and when dry, it has deep cracks at the surface. The root zone is deep, but the clayey layers restrict penetration of some plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Denton, Frio, and Leeray soils. Denton soils are on the upper parts of slopes, Frio soils are along drainageways, and Leeray soils are in areas of gilgai microrelief. Areas of these included soils are less than 5 acres and together make up less than 20 percent of any mapped area.

This soil is used mostly as cropland. Potential for crops, such as grain sorghum, cotton, corn, and small grain, is high. Crop residue left on the surface helps conserve moisture, improve tilth, and maintain productivity. Tillage should be limited and timely. Potential for pasture grasses is medium; grasses, such as King Ranch bluestem, Kleingrass, and bermudagrass, are suited to this soil.

Potential for native range plants is high. The climax plant community is an open prairie that supports an abundant growth of mid and tall grasses. Management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential for most urban uses is medium. Shrink-swell potential, slow water intake rate, and low strength are concerns that must be overcome in design. Capability subclass IIs; Clay Loam range site.

KcB—Krum silty clay, 1 to 3 percent slopes. This deep, well drained, gently sloping, clayey soil is in valleys. Soil areas are irregularly shaped and range from 20 to 600 acres.

The surface layer is dark grayish brown, calcareous silty clay about 36 inches thick. The subsoil is brown, calcareous silty clay that extends to a depth of 56 inches. The underlying material, to a depth of 62 inches or more, is pale brown, calcareous silty clay loam.

This soil is productive. Organic matter content is high. Permeability is moderately slow, and available water capacity is high. Tilth is poor, and the soil can be worked only in a narrow range of moisture conditions. When wet, the soil is sticky and plastic, and when dry, it has deep cracks at the surface. The root zone is deep, but the clayey layers restrict penetration of some plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Denton, Frio, and Leeray soils. Denton soils are on the upper parts of slopes, Frio soils are along drainageways, and Leeray soils are in areas of gilgai microrelief. Areas of these included soils are less than 10 acres and together make up less than 20 percent of any mapped area.

This soil is mostly used as cropland. Potential for crops, such as grain sorghum, cotton, corn, and small grain, is high. Terraces and contour cultivation help control erosion. Crop residue left on the surface helps reduce runoff, conserve moisture, improve tilth, and maintain productivity. Potential for pasture grasses is high; grasses, such as bermudagrass, Kleingrass, and King Ranch bluestem, are suited to this soil.

Potential for native range plants is high. The climax plant community is an open prairie supporting an abundant growth of mid grasses. Management concerns include proper grazing use, which includes adequate rest periods, and brush management.

Potential for most urban uses is medium. Shrink-swell potential, slow water intake rate, and low strength are limitations that must be overcome by special design. Capability subclass IIe; Clay Loam range site.

La—Lamkin clay loam, occasionally flooded. This deep, well drained, nearly level, loamy soil is in narrow areas on flood plains. Areas are oblong and are on natural levees along and on either side of stream channels. The stream channel is of sufficient depth and size to prevent all but an occasional damaging flood. Soil areas range from 10 to 500 acres.

The surface layer is dark grayish brown, calcareous clay loam about 16 inches thick. The underlying material is pale brown, calcareous silt loam to a depth of 36 inches; very pale brown, calcareous very fine sandy loam to a depth of 42 inches; pale brown, calcareous silt loam to a depth of 54 inches; and brown, calcareous silty clay loam to a depth of 62 inches or more.

This soil is productive. Permeability is moderate, and available water capacity is high. The soil has good tilth and can be worked over a wide range of moisture conditions. It is flooded occasionally and for short periods. The root zone is deep and easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Deleon, Energy, and Frio soils. Energy soils are along the stream channel, where the most recent soil deposits have been made, and Deleon and Frio soils are in areas where the flood plain broadens. Areas of these included soils are less than 10 acres and make up less than 20 percent of any mapped area.

This soil is mostly used as pasture. Potential for pasture grasses is high; bermudagrass and Kleingrass are well suited to this soil. Potential for crops such as grain sorghum, forage sorghum, alfalfa, and small grain is high. Crop residue left on the surface helps conserve moisture, reduce soil temperature, and maintain soil productivity. This soil has high potential for pecans.

Potential for native range plants is high. The climax plant community is a tall grass savannah with numerous tall trees. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential for most urban uses is low. The occasional damaging floods can be overcome only by major flood-control measures. Capability subclass IIw; Loamy Bottomland range site.

Lb—Lamkin soils, frequently flooded. These deep, well drained, nearly level soils are in narrow areas on flood plains. Areas are irregular to oblong and are along natural levees of larger streams. They range from 20 to 500 acres. The texture of the surface layer ranges from loam to clay loam. These soils are not uniform and occur in irregular patterns. In some areas near the stream channel they have a slightly undulating surface.

The surface layer is dark grayish brown, calcareous clay loam about 14 inches thick. The underlying material is stratified alluvium. It is pale brown, calcareous silt loam to a depth of 32 inches; brown, calcareous silty clay loam to a depth of 48 inches; and very pale brown, calcareous very fine sandy loam to a depth of 60 inches or more.

These soils are productive. Permeability is moderate, and available water capacity is high. The soil has good tilth and can be worked over a wide range of moisture conditions. It is flooded frequently and for short periods. The root zone is deep and easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with these soils in mapping are small areas of Deleon, Energy, and Frio soils. Energy soils are near the stream channel in areas of more recent soil deposition, and Deleon and Frio soils are in areas where the flood plain broadens or are along old alternate channels. Areas of these included soils are less than 10 acres and make up less than 20 percent of any mapped area.

These soils are mainly used as pasture. Potential for pasture grasses is high. Bermudagrass and Kleingrass are well suited to these soils. These soils have high potential for pecans. Potential for cropland is low because of frequent flooding.

Potential for native range plants is high. The climax plant community is a tall grass savannah with numerous tall trees. Major management concerns include proper grazing use, which includes adequate rest periods, and brush management.

Potential for most urban uses is low. Frequent flooding can be overcome only by major flood-control measures. Capability subclass Vw; Loamy Bottomland range site.

LcA—Leeray clay, 0 to 1 percent slopes. This deep, well drained, nearly level, clayey soil is on uplands. Slopes are plane and have gilgai microrelief. Areas range from 10 to 100 acres.

The surface layer is dark grayish brown, calcareous clay to a depth of 32 inches and grayish brown, calcareous clay to a depth of 50 inches. This layer has grooved slickensides. The underlying material, to a depth of 70 inches or more, is light olive brown, calcareous shaly clay that contains numerous soft bodies of calcium carbonate.

This soil is productive. Organic matter content is high, and permeability is very slow. Water enters the soil rapidly through cracks when the soil is dry (fig. 8), but very slowly when the soil is moist. Available water capacity is high. Tilth is poor, and the soil can be worked only in a narrow range of moisture conditions. The soil is very sticky and plastic when wet. When the soil is dry, the surface layer has cracks that extend several feet into the soil. The root zone is deep, but the clay layers restrict penetration of some plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Hassee, Krum, and Thurber soils. Each of these soils is in a position on the landscape similar to the position of Leeray soils, but the pattern is irregular. Areas of these included soils are less than 5 acres and together make up less than 15 percent of any mapped area.

This soil is mostly used as cropland. Potential for such crops as grain sorghum is high. The soil has medium potential for oats. Crop residue left on the surface helps conserve moisture and maintain productivity. Potential for pasture grasses is low; King Ranch bluestem and Kleingrass are suited to this soil.

Potential for native range plants is high. The climax plant community is an open prairie supporting an abundant growth of mid grasses. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential for most urban uses is medium. Shrink-swell potential and water intake rate are limitations that must be overcome in design or by modification of the soil. Capability subclass IIIs; Clay Loam range site.

LcB—Leeray clay, 1 to 3 percent slopes. This deep, well drained, gently sloping, clayey soil is on uplands. Slopes are plane and average about 2 percent. The soil has gilgai microrelief. Soil areas range from 10 to 100 acres and are mostly oval.

The surface layer is dark grayish brown, calcareous clay to a depth of 5 inches; very dark grayish brown, calcareous clay to a depth of 32 inches; and dark grayish brown, calcareous clay to a depth of 54 inches. The underlying material, to a depth of 65 inches or more, is grayish brown, calcareous clay.

This soil is productive. Organic matter content is high. Permeability is very slow, and available water capacity is high. Water enters the soil rapidly through cracks when the soil is dry, but very slowly when the soil is moist. The soil is very sticky and plastic when wet, but it cracks deeply when dry. The range of moisture conditions in which the soil can be worked is narrow. The root zone is deep, but the clay layers restrict penetration of plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Hassee, Krum, and Thurber soils. Each of these soils is in a position on the landscape similar to the position of Leeray soils, but the pattern is irregular. Areas of the included soils are less than 5 acres and together make up less than 20 percent of any mapped area.

This soil is mainly used as cropland. Potential for row crops, including sorghum and small grain, is medium. Terraces and contour cultivation help control erosion. Crop residue left on the surface helps conserve moisture, reduce soil temperature, and maintain soil productivity. Potential for pasture grasses is low; Kleingrass and King Ranch bluestem are adapted to this soil.

Potential for native range plants is high. The climax plant community is an open prairie supporting an abundant growth of mid grasses. Major management objectives are proper grazing use, which includes adequate rest periods, and brush management.

Potential for most urban uses is medium. Shrink-swell potential and water intake rate must be overcome in design or by modification of the soil. Capability subclass IIIe; Clay Loam range site.

LeB—Lewisville clay loam, 1 to 3 percent slopes. This deep, well drained, gently sloping, loamy soil is in narrow, curved bands on stream terraces. Areas are mainly less than 30 acres, but range from 10 to 100 acres.

The surface layer is dark grayish brown, calcareous clay loam about 18 inches thick. The subsoil is light brownish gray, calcareous silty clay loam to a depth of 26 inches; pale brown, calcareous silty clay loam to a depth of 46 inches; and light yellowish brown, calcareous clay loam to a depth of 62 inches or more.

This productive soil is high in organic matter content. Permeability is moderate, and available water capacity is high. The soil has good tilth and can be worked during a wide range of moisture conditions. The root zone is deep and easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small, narrow areas of Bosque or Venus soils. Included soils make up less than 10 percent of any mapped area.

This soil is mostly used as cropland. Potential for crops, such as grain sorghum, alfalfa, corn, truck crops, and small grain, is high. Terraces and contour cultivation help control erosion. Crop residue left on the surface helps conserve moisture, reduce runoff, and maintain productivity. Potential for pasture grasses is high. Bermudagrass, Kleingrass, and lovegrass are suited to this soil.

Potential for native range plants is high. The climax plant community is an open prairie that supports an abundant growth of mid and tall grasses. The main management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential for most urban uses is medium. Shrink-swell potential and low strength can be overcome by proper design and careful installation procedures. Capability subclass IIe; Clay Loam range site.

LeC—Lewisville clay loam, 3 to 5 percent slopes. This deep, well drained, gently sloping, loamy soil is in narrow, curved bands on terraces. Areas range from 10 to 50 acres.

The surface layer is dark grayish brown, calcareous clay loam about 11 inches thick. The subsoil is grayish brown, calcareous silty clay loam to a depth of 30 inches and brown, calcareous silty clay loam to a depth of 48 inches. The underlying material, to a depth of 62 inches or more, is very pale brown, calcareous silty clay loam.

This soil is productive. Organic matter content is high. Permeability is moderate, and available water capacity is high. The soil has good tilth and can be worked over a wide range of moisture conditions. The root zone is deep and easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Karnes and Venus soils. Karnes soils are on the upper parts of slopes, and Venus soils are on more gentle slopes. Areas of these included soils are less than 5 acres and together make up less than 20 percent of any mapped area.

This soil is mostly used as rangeland. Potential for native range plants is high. The climax plant community is an open prairie that supports an abundant growth of tall and mid grasses. The major management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential for such crops as sorghum, corn, and small grain is high. Terraces and contour cultivation help control erosion. Crop residue left on the soil surface helps reduce runoff, conserve moisture, and maintain productivity. Potential for pasture grasses is high. Bermudagrass and Kleingrass are suited to this soil.

Potential for most urban uses is medium. Shrink-swell potential and low strength can be overcome by proper design and careful installation practices. Capability subclass IIIe; Clay Loam range site.

LuB—Luckenbach clay loam, 1 to 3 percent slopes. This moderately deep, moderately well drained, gently sloping, loamy soil is in slightly concave areas on stream terraces and in valleys. Most areas range from 10 to 40 acres and are irregularly shaped.

The surface layer is dark brown, mildly alkaline clay loam about 8 inches thick. The subsoil is brown and reddish brown, mildly alkaline clay loam to a depth of 22 inches; and reddish brown, calcareous clay loam to a depth of 36 inches. The underlying material to a depth of 50 inches is pink clay loam that contains many concretions of calcium carbonate. Extending to a depth of 52 inches or more is pale brown, calcareous clay loam.

This productive soil is moderate in organic matter content. Permeability is moderately slow, and available water capacity is high. The soil has fair tilth and can be worked over a wide range in moisture conditions. The root zone is moderately deep. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are areas of Abilene and Pedernales soils. Abilene soils are along drainageways, and Pedernales soils are on convex knolls. These included soils make up less than 15 percent of any mapped area.

This soil is used mostly as cropland. Potential for crops, such as grain sorghum and small grain, is high. Terraces and contour cultivation help control erosion. Crop residue left on the surface helps reduce runoff, conserve moisture, and maintain tilth and productivity. Potential for pasture grasses is medium. Kleingrass, bermudagrass, and King Ranch bluestem are adapted to this soil.

Potential for native range plants is high. The climax plant community is an open prairie that supports an abundant growth of mid and tall grasses. The major management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential for most urban uses is high. Shrink-swell potential can be overcome by proper design and installation procedures. The clay loam lower layers take in water more slowly than the optimum rate for septic tank absorption fields, but this can be overcome by increasing the size of the absorption area or by modifying the filter field itself. Capability subclass IIe; Clay Loam range site.

MfA—May fine sandy loam, 0 to 1 percent slopes. This deep, well drained, nearly level, loamy soil is on low stream terraces and in valleys on uplands. Areas are long and narrow and range from 7 to 50 acres.

The surface layer is brown, slightly acid fine sandy loam about 12 inches thick. The subsoil is brown, neutral sandy clay loam to a depth of 37 inches and brown, calcareous sandy clay loam to a depth of 41 inches. The underlying material, to a depth of 62 inches or more, is very pale brown, calcareous sandy clay loam.

This soil is productive. Permeability is moderate, and available water capacity is high. This soil receives additional moisture in the form of runoff from other, higher soils. A hard crust forms on the surface when the soil is dry. The soil can be worked through a wide range of moisture conditions. The root zone is deep and easily penetrated by plant roots. The hazard of soil blowing is moderate, and the hazard of water erosion is slight.

Included with this soil in mapping are small areas of Energy and Menard soils. Energy soils are along flood plains, and Menard soils are on low knolls. Areas of these included soils are each less than 5 acres and together make up less than 20 percent of any mapped area.

This soil is mainly used as cropland. Potential for sorghum, peanuts, truck crops, pecans, and small grain is high. Crop residue left on the surface helps conserve moisture, reduce soil temperature, and maintain soil tilth and productivity. Crops on the soil respond well to fertilizers. Potential for pasture grasses is high. Coastal bermudagrass, lovegrass, and Kleingrass are well suited to this soil.

Potential for native range plants is high. The climax plant community is an open savannah of post oak trees and an understory of tall and mid grasses. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential for most urban uses is high. Shrink-swell potential and low strength are easily overcome by proper design and installation procedures. Protection from runoff from adjacent higher areas is needed in places. Capability class I; Sandy Loam range site.

MfB—May fine sandy loam, 1 to 3 percent slopes. This deep, well drained, gently sloping, loamy soil is on benches of stream terraces in valleys on uplands. Areas are irregularly shaped and range from 10 to 60 acres.

The surface layer is dark brown, neutral fine sandy loam about 8 inches thick. The subsoil is dark brown, neutral sandy clay loam to a depth of 36 inches and brown, calcareous sandy clay loam to a depth of 58 inches. The underlying material, extending to a depth of 62 inches or more, is very pale brown, calcareous sandy clay loam.

This soil is productive. Permeability is moderate, and available water capacity is high. This soil normally receives additional moisture in the form of runoff from higher soils. A hard crust forms on the surface when the soil is dry. The range in moisture conditions at which the soil can be worked is wide. The root zone is deep and easily penetrated by plant roots. The water erosion and soil blowing hazards are moderate.

Included with this soil in mapping are small areas of Abilene, Energy, and Menard soils. Abilene soils are in slightly concave depressions, Energy soils are along flood plains, and Menard soils are in slightly convex areas on the upper parts of slopes. Areas of these included soils are each less than 5 acres and together make up less than 20 percent of any mapped area.

This soil is mainly used as cropland. Potential for peanuts, sorghum, and corn is high. Pecan orchards and truck crops are also well suited. Terraces and contour cultivation help control erosion. Crop residue left on the surface helps conserve moisture, reduce runoff, and maintain productivity and tilth. Crops on the soil respond well to fertilizers. Potential for pasture grasses is high. Coastal bermudagrass, lovegrass, and Kleingrass are well suited to this soil.

Potential for native range plants is high. The climax plant community is an open savannah of post oak trees and an understory of tall and mid grasses. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential for most urban uses is high. Shrink-swell potential and low strength can be easily overcome by proper design and installation procedures. Capability subclass IIe; Sandy Loam range site.

MnB—Menard fine sandy loam, 1 to 3 percent slopes. This deep, well drained, gently sloping, loamy soil is on low knolls. Slopes are plane to slightly convex. Areas are irregularly shaped and range from 10 to 80 acres, but are dominantly about 30 acres.

The surface layer is brown, neutral fine sandy loam about 6 inches thick. The subsoil is reddish brown, neutral sandy clay loam to a depth of 34 inches and brown, calcareous sandy clay loam to a depth of 44 inches. The underlying material, to a depth of 60 inches or more, is reddish yellow, calcareous clay loam.

Permeability is moderate, and available water capacity is high. The surface is very hard and crusty when dry. The soil can be worked over a wide range of moisture conditions. The root zone is deep and easily penetrated by plant roots. The hazards of water erosion and soil blowing are moderate.

Included with this soil in mapping are small areas of Karnes and Pedernales soils. Karnes soils are on circular knobs, and Pedernales soils are in convex areas on the lower parts of slopes. Areas of the included soils are less than 5 acres and together make up less than 20 percent of any mapped area.

This soil is used mainly as rangeland. Potential for native range plants is high. The climax plant community is an open savannah of post oak trees and an understory of tall and mid grasses. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential for such crops as grain sorghum and oats is medium. Potential for peanuts is high. Terraces and contour cultivation help control erosion. Crop residue left on the surface helps conserve moisture, reduce soil temperature, and maintain soil productivity and tilth. Crops on the soil respond well to fertilizers. Potential for pasture grasses is medium; bermudagrass, Kleingrass, and lovegrass are suited to this soil.

Potential for most urban uses is high. Capability subclass IIe; Sandy Loam range site.

MnC—Menard fine sandy loam, 3 to 5 percent slopes. This deep, well drained, gently sloping, loamy soil is on side slopes and foot slopes on uplands. Slopes are convex. Soil areas are irregularly shaped and range from 10 to 70 acres.

The surface layer is brown, neutral fine sandy loam about 10 inches thick. The subsoil is yellowish red, slightly acid sandy clay loam to a depth of 18 inches; yellowish red, neutral sandy clay loam to a depth of 30 inches; and reddish yellow, calcareous sandy clay loam to a depth of 34 inches. The underlying material, to a depth of 60 inches or more, is very pale brown, calcareous sandy clay loam.

Permeability is moderate, and available water capacity is high. The surface of this soil is very hard and crusty when dry. The soil can be easily worked during a wide range of moisture conditions. The root zone is deep and easily penetrated by plant roots. The hazards of water erosion and soil blowing are moderate.

Included with this soil in mapping are small areas of Karnes and Pedernales soils in convex areas on the lower parts of slopes. Areas of these included soils are less than 5 acres and together make up less than 20 percent of any mapped area.

This soil is used mainly as rangeland. Potential for native range plants is high. The climax plant community is an open savannah of post oak trees and an understory of tall and mid grasses. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential for such crops as grain sorghum and oats is medium. Potential for peanuts is high. Terraces and contour cultivation help control erosion. Crop residue left on the surface helps conserve moisture, reduce soil temperatures, and maintain soil productivity and tilth. Crops on this soil respond well to fertilizers. Potential for pasture grasses is medium; bermudagrass, Kleingrass, and lovegrass are suited to this soil.

Potential for most urban uses is high. Capability subclass IIIe; Sandy Loam range site.

MnD—Menard fine sandy loam, 5 to 8 percent slopes. This deep, well drained, sloping, loamy soil is on uplands. Slopes are convex. Areas are irregularly shaped and range from 5 to 75 acres.

The surface layer is brown, neutral fine sandy loam about 6 inches thick. The subsoil is reddish brown, slightly acid sandy clay loam to a depth of 12 inches; yellowish red, neutral sandy clay loam to a depth of 24 inches; and reddish yellow, calcareous sandy clay loam to a depth of 36 inches. The underlying material, to a depth of 70 inches or more, is pink, calcareous clay loam.

Permeability is moderate. Available water capacity is high. The surface is hard and crusty when dry. The soil has fair tilth. The root zone is deep and easily penetrated by plant roots. The hazard of water erosion is severe, and the hazard of soil blowing is moderate.

Included with this soil in mapping are small areas of Karnes and Pedernales soils. Karnes soils are on circular knolls, and Pedernales soils are on the lower parts of side slopes. Areas of these included soils are less than 5 acres and together make up less than 20 percent of any mapped area.

This soil is used as rangeland. Potential for native range plants is high. The climax plant community is an open savannah of post oak trees and an understory of tall and mid grasses. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential for row crops, such as peanuts and grain sorghum, is low. Potential for closely spaced or sown crops, such as oats, is medium. Slope and the severe hazard of erosion make this soil better suited to grasses than to other crops. Potential for pasture grass is medium; bermudagrass, Kleingrass, and lovegrass are suited to this soil. Potential for most urban uses is high. Capability subclass IVe; Sandy Loam range site.

MsC2—Menard soils, 1 to 5 percent slopes, eroded. These deep, well drained, gently sloping, loamy soils are in convex areas on uplands. Mapped areas are irregularly shaped and range from 5 to 30 acres. Erosion has thinned the surface layer. In cultivated areas the lower layers have been mixed with the surface layer, so the surface layer now has variable texture. The texture of the surface layer ranges from fine sandy loam to sandy clay loam. Composition of mapped areas and their pattern on the landscape are not uniform. Many areas have shallow gullies or rills 75 to 100 feet apart and several inches deep.

The surface layer is brown, neutral fine sandy loam about 3 inches thick. The subsoil is reddish brown, neutral sandy clay loam to a depth of 12 inches; yellowish red, neutral sandy clay loam to a depth of 24 inches; and yellowish red, calcareous sandy clay loam to a depth of 38 inches. The underlying material, to a depth of 60 inches or more, is pink, calcareous sandy clay loam.

Permeability is moderate, and available water capacity is high. The surface is hard and crusty when dry. It can be worked over a moderate range of moisture conditions. The root zone is deep and easily penetrated by plant roots. The hazards of water erosion and soil blowing are moderate.

Included with these soils in mapping are small areas of Karnes and Pedernales soils. Karnes soils are usually on small, circular knolls, and Pedernales soils are usually on the lower parts of slopes. Areas of these included soils are each less than 5 acres and together make up less than 20 percent of any mapped area.

Most areas of these soils were once farmed, but are now being converted to rangeland or pasture. Potential for crops such as peanuts and grain sorghum is low. Terraces and contour cultivation help control erosion. Crop residue left on the surface helps conserve moisture, reduce runoff, and improve tilth and productivity. Potential for pasture grasses is medium; bermudagrass and Kleingrass are suited to this soil.

Potential for native range plants is medium. The climax plant community was an open savannah of post oak trees and an understory of tall and mid grasses. Major management concerns are proper grazing use, which includes adequate rest periods, range seeding, and brush management.

Potential for most urban uses is high. Capability subclass IIIe; Sandy Loam range site.

MsD3—Menard soils, 1 to 8 percent slopes, severely eroded. These deep, well drained, gently sloping to sloping, severely eroded, loamy soils are on uplands. Areas are irregularly shaped and range from 3 to 50 acres. Gullies, about 3 to 5 feet deep and 4 to 6 feet wide, are at intervals of about 35 feet. Texture of the surface layer ranges from fine sandy loam to sandy clay loam. Composition of mapped areas and their pattern on the landscape are not uniform.

The surface layer is brown, neutral fine sandy loam about 4 inches thick. The subsoil is reddish brown, neutral sandy clay loam to a depth of 16 inches; yellowish red, neutral sandy clay loam to a depth of 26 inches; and strong brown, calcareous sandy clay loam to a depth of 38 inches. The underlying material, to a depth of 62 inches or more, is pink, calcareous sandy clay loam.

These soils are moderately permeable and have high available water capacity. The root zone is deep and easily penetrated by plant roots. The hazard of water erosion is severe, and the hazard of soil blowing is moderate.

Included with these soils in mapping are small areas of Pedernales soils on the lower parts of slopes. Areas are less than 3 acres and make up less than 20 percent of any mapped area.

These soils are used as rangeland. Potential for native range plants is medium. Many of the areas were formerly cropped and are now revegetating naturally. The original climax plant community was an open savannah of post oak trees and an understory of tall and mid grasses. Major management concerns are proper grazing use, which includes adequate rest periods, range seeding, and brush management.

Potential for crops and pasture grasses is low. If gullies are smoothed and shaped and planted to bermudagrass, gullied areas can be converted to pasture. Fertilization and careful proper grazing management are required to maintain adequate grass cover and prevent additional erosion.

Potential for urban uses is medium. Gullies must be extensively shaped and vegetated if the area is to be made attractive for most uses, but even then special treatment is required to prevent further erosion. Capability subclass VIe; Sandy Loam range site.

NmC—Nimrod fine sand, 0 to 5 percent slopes. This deep, moderately well drained, nearly level to gently sloping or gently undulating, sandy soil is in broad areas on uplands. Areas are irregularly shaped and range from 15 to 300 acres.

The surface layer is medium acid, pale brown fine sand to a depth of 6 inches. The subsurface layer is slightly acid, very pale brown fine sand that extends to a depth of 26 inches. The subsoil is brownish yellow, medium acid, mottled sandy clay loam to a depth of 34 inches; light gray, strongly acid, mottled sandy clay loam to a depth of 52 inches; and light gray, medium acid, mottled sandy clay loam to a depth of 72 inches. The underlying material, extending to a depth of 80 inches or more, is light gray, slightly acid, mottled sandy clay loam.

Permeability is rapid in the sandy upper layers and moderately slow in the lower layers. Available water capacity is medium. The thick sandy surface layer can be worked over a wide range in moisture conditions. The surface layer absorbs water rapidly, and water collects for short periods above the sandy clay loam lower layers following periods of high rainfall. The hazard of soil blowing is severe (fig. 9), and the hazard of water erosion is slight. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Chaney, Demona, and Patilo soils. Chaney soils are on low knolls, and Demona and Patilo soils are in the same positions in the landscape as Nimrod soils. Areas of these included soils are less than 10 acres and together make up less than 30 percent of any mapped area.

This soil is used mostly as cropland. Potential for crops such as peanuts and truck crops is high. Potential for grain sorghum and small grains is medium. Cover cropping and wind stripcropping help prevent soil blowing. Crop residue left on the surface helps conserve moisture and maintain soil productiviy. Crops on this soil respond well to frequent applications of fertilizer. Pecans, apples, pears, and watermelons are well suited to this soil. Potential for pasture grasses is medium; improved grasses such as Coastal bermudagrass or lovegrass are well suited to this soil. Frequent applications of fertilizer are essential to maintain a vigorous stand of grass.

Potential for native range plants is high. The climax plant community is a post oak and blackjack oak savannah and an understory of tall and mid grasses. Major management concerns include proper grazing use, which includes adequate rest periods, and brush management.

Potential for most urban uses is medium. Seasonal wetness can be overcome only by proper drainage measures. Capability subclass IIIe; Sandy range site.

OcC—Owens clay, 1 to 5 percent slopes. This shallow, well drained, gently sloping, clayey soil is on foot slopes. Areas are long and narrow and range from 10 to 40 acres. Slope ranges from 1 to 5 percent, but is 1 to 3 percent in most places.

The surface layer is light olive brown, calcareous, very firm clay about 8 inches thick. The subsoil is olive brown, calcareous, very firm clay that extends to a depth of 18 inches. Below that is olive yellow, calcareous, massive shale.

This soil is very slowly permeable, and available water capacity is very low. The surface is very hard and crusty when dry. Runoff is high. The soil can be worked over only a narrow range in moisture conditions. The root zone is shallow, and penetration of plant roots is restricted by the shale. The hazard of water erosion is severe, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Truce soils on the lower parts of slopes in areas of generally less than 5 acres. These included soils make up less than 20 percent of any mapped area.

This soil is used mostly as rangeland. Potential for native range plants is low. The climax plant community is short grasses and scattered mid grasses. Major management concerns include proper grazing use, which includes adequate rest periods, and brush management.

Potential as cropland is low. The very low amount of water held available for plant use and the shallow root zone limit suitability of the soil for cropping systems. Small grain and forage sorghum are grown in a few areas, but because of droughty soil conditions, potential yields are low. Terraces and contour cultivation help control erosion. Crop residue left on the surface helps conserve moisture, reduce runoff, and maintain productivity. Potential for pasture grasses is low; King Ranch bluestem is adapted to this soil.

Potential for most urban uses is low. Shrink-swell potential, water intake rate, and low strength are very difficult to overcome. Capability subclass IVe; Shallow Clay range site.

OwG—Owens stony clay, 3 to 25 percent slopes. This shallow, well drained, gently sloping to steep, stony, clayey soil is on stony escarpments on uplands. Areas are long and narrow and range from 10 to 60 acres (fig. 10). Fragments of sandstone, limestone, and ironstone, 6 to 48 inches in diameter, cover 5 to 20 percent of the surface. Water erosion has created small gullies, 6 to 36 inches deep and 30 to 100 inches wide, at intervals of 30 to 75 feet.

The surface layer is grayish brown, calcareous stony clay about 6 inches thick. The subsoil is grayish brown, calcareous clay that extends to a depth of 16 inches. Below that is light olive brown, calcareous, massive shaly clay.

This soil is very slowly permeable. Available water capacity is very low. The surface is very hard and crusty when dry. The root zone is shallow; penetration of plant roots is restricted by the clay layers. Runoff is very rapid. The hazard of water erosion is severe, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Tarrant and Truce soils. Tarrant soils are usually on the upper parts of slopes, and Truce soils are usually on the lower parts of foot slopes. Areas of these included soils are less than 5 acres and together make up less than 20 percent of any mapped area.

This soil is used as rangeland. Potential for native range plants is low. The climax plant community is short grasses and scattered mid grasses. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential for crops and pasture grasses is low. Slope, the stony surface, and the severe hazard of erosion make these soils better suited to native range plants than to other crops.

Potential for most urban uses is low. Stones, slope, shrink-swell potential, and low strength are very difficult to overcome. Capability subclass VIIs, Rocky Hills range site.

PaC—Patilo-Nimrod complex, 0 to 5 percent slopes. This soil complex consists of deep, moderately well drained, nearly level to gently undulating, sandy soils on uplands. Areas are irregularly shaped and range from 5 to 300 acres.

About 68 percent of this complex is Patilo soils and other similar soils, about 29 percent is Nimrod and similar soils, and about 3 percent is other soils. Patilo soils dominate the complex, and the other soils are in patterns too intricate to be delineated at the scale of mapping used. Nimrod soils are in a random pattern on the landscape.

Patilo soils have a surface layer of brown, neutral fine sand about 4 inches thick. The subsurface layer is white, slightly acid fine sand that extends to a depth of 44 inches. The subsoil is mottled light gray, yellow, and red, medium acid sandy clay loam to a depth of 50 inches; light gray, mottled, strongly acid sandy clay loam to a depth of 60 inches; and light gray, mottled, strongly acid, sandy clay loam to a depth of 70 inches or more.

Patilo soils have rapid permeability in the upper layers and moderately slow permeability in the lower layers. Available water capacity is low. Water accumulates above the sandy clay loam lower layers for short periods following heavy rainfall. The fine sand surface layer is loose when dry. The soil can be worked over a wide range of moisture conditions. The root zone is deep. The hazard of water erosion is slight, and the hazard of soil blowing is severe.

Nimrod soils have a surface layer of neutral, pale brown fine sand about 4 inches thick. The subsurface layer is slightly acid, very pale brown fine sand that extends to a depth of 36 inches. The subsoil is brownish yellow, strongly acid sandy clay loam mottled with light gray and yellowish red to a depth of 48 inches and light gray, strongly acid sandy clay loam mottled with yellowish red and brownish yellow to a depth of 64 inches or more.

Available water capacity is medium. The surface layer absorbs water rapidly, and water accumulates above the lower layers for brief periods following periods of rainfall. The soil can be worked over a wide range of moisture conditions. The root zone is deep and easily penetrated by plant roots. The hazard of water erosion is slight, and the hazard of soil blowing is severe.

Included with these soils in mapping are a few small areas of Chaney soils on small, convex knolls. Areas of these included soils are less than 5 acres and make up less than 20 percent of any mapped area.

This complex is dominantly used as pasture. It has medium potential for pasture grasses; bermudagrass and lovegrass are suited to these soils. Potential for such crops as peanuts and sorghum is medium, but the crops suffer from lack of moisture and grow slowly except during periods of favorable rainfall. Cover cropping and wind stripcropping help control soil blowing. Crop residue left on the surface helps conserve moisture, improve productivity, and control soil blowing. Crops on these soils respond well to frequent applications of fertilizer.

Potential for native range plants is medium. The climax plant community is an open stand of post oak and blackjack oak and an understory of tall and mid grasses. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential for most urban uses is medium. Temporary wetness, slow water intake rate in the lower layers, and the thick, loose, sandy surface layer need to be overcome in design. Capability subclass IIIe; Patilo soil in Deep Sand range site, Nimrod soil in Sandy range site.

PdC—Pedernales loamy fine sand, 1 to 5 percent slopes. This deep, well drained, gently sloping, sandy soil is in broad areas on uplands. Areas are irregularly shaped and range from 10 to 300 acres.

The surface layer is brown, neutral loamy fine sand about 8 inches thick. The subsoil is yellowish red, neutral sandy clay that extends to a depth of 36 inches. The underlying material, to a depth of 60 inches or more, is pink, calcareous sandy clay loam.

Permeability is moderately slow, and available water capacity is high. The root zone is deep, but penetration of some plant roots is restricted by the clayey lower layers. The hazard of water erosion is moderate, and the hazard of soil blowing is severe.

Included with this soil in mapping are small areas of Chaney soils and a soil that is similar to Pedernales soils except that it does not have limy underlying material within a depth of 60 inches. Both of these included soils are on the lower parts of slopes. Areas are less than 10 acres and make up less than 20 percent of any mapped area.

This soil is used mainly as cropland. Potential for peanuts, oats, and truck crops is high. Potential for sorghum is medium. Apple, pear, and peach trees are also well suited to this soil. Cover cropping, wind stripcropping, and crop residue left on the surface help control soil blowing, conserve moisture, and maintain productivity. Crops on the soil respond well to fertilization. Potential for pasture grasses is medium; bermudagrass, Kleingrass, and lovegrass are suited to this soil.

Potential for native range plants is medium. The climax plant community is a mixture of tall and mid grasses and a partial canopy of post oak trees. Major management concerns include proper grazing use, which includes adequate rest periods, and brush management.

Potential for most urban uses is high. Moderate shrink-swell potential, slow water intake rate, and low strength can be overcome by proper design and installation procedures. Capability subclass IIIe; Loamy Sand range site.

PeB—Pedernales fine sandy loam, 1 to 3 percent slopes. This deep, well drained, gently sloping, loamy soil is in broad areas on uplands. Areas are irregularly shaped and range from 5 to 200 acres.

The surface layer is brown, slightly acid fine sandy loam about 10 inches thick. The subsoil is reddish brown, slightly acid sandy clay to a depth of 28 inches; yellowish red, neutral sandy clay to a depth of 38 inches; and reddish yellow, neutral sandy clay loam to a depth of 48 inches. The underlying material, to a depth of 60 inches or more, is pink, calcareous sandy clay loam that contains numerous concretions of calcium carbonate.

Permeability is moderately slow, and available water capacity is high. Tilth is poor. The surface layer is hard and crusty when dry. The range in moisture conditions at which the soil can best be worked is moderate. The root zone is deep, but some plant roots are restricted by the clayey lower layers. The hazards of water erosion and soil blowing are moderate.

Included with this soil in mapping are small areas of Menard soils and a soil that is similar to Pedernales soils except that it does not have limy underlying material within a depth of 60 inches. Menard soils are usually on the upper parts of slopes or knolls, and the similar soil is usually on the lower parts of slopes. Areas of the included soils are less than 10 acres and together make up less than 20 percent of any mapped area.

This soil is used mainly as cropland. Potential for such crops as peanuts, grain sorghum, and truck crops is medium. Apple, peach, and pear trees are well suited to this soil. Terraces and contour cultivation help reduce erosion. Crop residue left on the surface helps conserve moisture, reduce runoff, and maintain soil productivity and tilth. Crops on this soil respond well to fertilizers. Potential for pasture grasses is low; Kleingrass, bermudagrass, and lovegrass are suited to this soil.

Potential for native range plants is medium. The climax plant community is a mixture of mid and short grasses and forbs. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential for most urban uses is high. Moderate shrink-swell potential and low strength are easily overcome by proper design. The water intake rate is slower than optimum for septic tank filter fields, but this can be overcome by increasing the size of the absorption area or by modifying the system itself. Capability subclass IIe; Tight Sandy Loam range site.

PeC—Pedernales fine sandy loam, 3 to 5 percent slopes. This deep, well drained, gently sloping, loamy soil is on uplands. Slopes are plane to convex. Areas are irregularly shaped and range from 5 to 50 acres.

The surface layer is brown, slightly acid fine sandy loam about 9 inches thick. The subsoil is red, slightly acid sandy clay to a depth of 20 inches; yellowish red, neutral sandy clay to a depth of 30 inches; and yellowish red, calcareous sandy clay to a depth of 48 inches. The underlying material, to a depth of 60 inches or more, is reddish yellow, calcareous sandy clay loam.

Permeability is moderately slow, and available water capacity is high. Tilth is poor, and the soil can be worked well through a moderate range of moisture conditions. The root zone is deep, but penetration of some plant roots is restricted by the clayey lower layers. The hazards of water erosion and soil blowing are moderate.

Included with this soil in mapping are small areas of Karnes and Menard soils on convex knolls. Areas of these included soils are less than 5 acres and together make up less than 20 percent of any mapped area.

This soil is used mostly as rangeland. Potential for native range plants is medium. The climax plant community is a mixture of mid and short grasses and forbs. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential for crops, such as grain sorghum and small grain, is medium. Terraces and contour cultivation help control erosion. Crop residue left on the surface helps conserve moisture, regulate soil temperature, and maintain soil productivity and tilth. Crops on this soil respond well to fertilization. Potential for pasture production is low; Kleingrass, bermudagrass, and King Ranch bluestem are adapted to this soil.

Potential for most urban uses is high. Moderate shrink-swell potential, low strength, and slow water intake rate can be overcome by proper design and installation procedures. The sandy clay lower layers take in water more slowly than the optimum rate for septic tank absorption fields, but this can be overcome by increasing the size of the absorption area or by modifying the filter field itself. Capability subclass IIIe; Tight Sandy Loam range site.

PeD—Pedernales fine sandy loam, 5 to 8 percent slopes. This deep, well drained, sloping, loamy soil is on uplands. Slopes are plane to convex. Areas are elongated along slope breaks into drainageways. They range from 10 to 200 acres, but are dominantly about 30 acres.

The surface layer is reddish brown, neutral fine sandy loam about 8 inches thick. The subsoil is red, neutral sandy clay to a depth of 16 inches; reddish brown, neutral sandy clay to a depth of 36 inches; and yellowish red, calcareous sandy clay that extends to a depth of 42 inches and that has common soft bodies of calcium carbonate. The underlying material, to a depth of 60 inches or more, is pink, calcareous sandy clay loam.

Permeability is moderately slow, and available water capacity is high. Tilth is poor. The root zone is deep, but penetration of some plant roots is restricted by the clayey lower layers. The hazard of water erosion is severe, and the hazard of soil blowing is moderate.

Included with this soil in mapping are small areas of Karnes and Menard soils and a soil that is similar to Pedernales soils except that the underlying limy material is at a depth of more than 60 inches. This similar soil is on slopes near the major streams, and Karnes and Menard soils are usually on the upper parts of convex slopes. Areas of these included soils are each less than 10 acres and together make up less than 30 percent of any mapped area.

This soil is used mainly as rangeland. Potential for native range plants is medium. The climax plant community is a mixture of mid and short grasses. Management concerns include proper grazing use, which includes adequate rest periods, and brush management.

Potential as cropland is low because of slopes, although forage sorghum is grown in a few areas. Potential for pasture grasses is low; bermudagrass is suited to this soil. Crops on this soil respond well to fertilizers.

Potential for most urban uses is medium. Shrink-swell potential, slope, low strength, and slow water intake rate affect urban uses. Capability subclass IVe; Tight Sandy Loam range site.

PsC2—Pedernales soils, 1 to 5 percent slopes, eroded. These deep, well drained, gently sloping, eroded soils are on uplands. Slopes are convex. Areas are irregularly shaped and range from 5 to 100 acres. Sheet erosion has removed approximately 75 percent of the original surface layer. There are a few gullies about 6 inches deep, but they can be crossed with farm machinery. Erosion of the surface layer has not been uniform, so the plow layer ranges from fine sandy loam to sandy clay loam. Composition of mapped areas and their pattern on the landscape are not uniform.

The surface layer is brown, neutral fine sandy loam about 4 inches thick. The subsoil is red, neutral sandy clay to a depth of 14 inches and yellowish red, neutral sandy clay to a depth of 42 inches. The underlying material, to a depth of 60 inches or more, is reddish yellow sandy clay loam that contains numerous bodies and concretions of calcium carbonate.

Permeability is moderately slow, and available water capacity is high. Tilth is poor. The root zone is deep, but the penetration of some plant roots is restricted by the clayey lower layers. The hazards of water erosion and soil blowing are moderate.

Included with these soils in mapping are small areas of Karnes soil and a soil that is similar to Pedernales soils except that the secondary carbonates are within 28 inches of the surface or the limy underlying material is at a depth of more than 60 inches. The Karnes soil is on low knolls. The soils that are similar to Pedernales soils are on low convex knolls or on the lower parts of slopes. These included soils make up less than 20 percent of any mapped area.

These soils are used mostly as cropland. Potential for small grain is medium, and potential for such crops as peanuts and grain sorghum is low. Apples, peaches, and pears are well adapted to this soil. Terraces, contour cultivation, and crop residue left on the surface help control erosion, conserve moisture, and maintain productivity. Crops on the soil respond well to fertilizer. Potential for pasture grasses is low; Kleingrass, bermudagrass, and King Ranch bluestem are suited to this soil.

Potential for native range plants is medium. The climax plant community is a mixture of mid and short grasses. Management concerns include proper grazing use, which includes adequate rest periods, and brush management.

Potential for most urban uses is high. Moderate shrink-swell potential, slow water intake rate, and low strength can be overcome by proper design. Capability subclass IIIe; Tight Sandy Loam range site.

PsD3—Pedernales soils, 1 to 8 percent slopes, severely eroded. These deep, well drained, gently sloping to sloping, loamy soils are on gullied uplands. Areas are irregularly shaped and range from 5 to 60 acres. V-shaped gullies, 3 to 5 feet deep and 6 to 10 feet wide, are at intervals of about 30 to 50 feet. Erosion of the surface layer has been uneven, so texture of the plow layer is fine sandy loam or sandy clay loam. Composition of mapped areas and their position on the landscape are not uniform.

The surface layer is brown, slightly acid fine sandy loam about 5 inches thick. The subsoil is red, neutral sandy clay to a depth of 12 inches; yellowish red, neutral sandy clay to a depth of 30 inches; and reddish yellow, neutral sandy clay to a depth of 44 inches. The underlying material, to a depth of 60 inches or more, is pinkish gray, calcareous sandy clay loam.

Permeability is moderately slow, and available water capacity is high. The root zone is deep, but the clayey lower layers restrict penetration of some plant roots. The hazard of water erosion is severe, and the hazard of soil blowing is moderate.

Included with these soils in mapping are small areas of Chaney and Menard soils. Menard soils are on the upper parts of slopes, and Chaney soils are on the lower parts of slopes. Areas of these included soils are less than 5 acres and together make up less than 20 percent of any mapped area.

These soils are used as rangeland. Potential for native range plants is low. Many of the areas were once cultivated and are now revegetating naturally. The original climax plant community was a mixture of mid and short grasses. Major management concerns are shaping of critical areas; reseeding; proper grazing use, which includes adequate rest periods; and brush management.

Potential for crops and pasture grasses is low. The gullies and the severe hazard of erosion affect use of the soils. In some areas the gullies are shaped and planted to bermudagrass. Fertilizing and careful grazing management are required to maintain an adequate grass cover and prevent additional erosion.

Potential for most urban uses is medium. Gullies need extensive shaping and vegetating for most uses. Special treatment is required to prevent additional erosion. Capability subclass VIe; Tight Sandy Loam range site.

PuB—Purves clay, 1 to 3 percent slopes. This shallow, well drained, gently sloping, clayey soil is on uplands. Slopes are plane to slightly convex. Areas are irregularly shaped and range from 5 to 125 acres.

The surface layer is dark grayish brown, calcareous clay to a depth of 7 inches and dark brown, calcareous clay to a depth of 16 inches. Below that is hard limestone.

Organic matter content is high. Permeability is moderately slow, and available water capacity is very low. This soil can be worked best in a narrow range of moisture conditions. Tillage needs to be timely and limited. The root zone is shallow but easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Bolar, Brackett, and Denton soils. Bolar soils are on the lower parts of slopes, Brackett soils are on the upper parts of slopes or on convex knolls, and Denton soils are in positions similar to those of the Purves soil. Areas of these included soils are less than 5 acres and together make up less than 20 percent of any mapped area.

This soil is mainly used as rangeland. Potential for native range plants is medium. The climax plant community is an open prairie of tall and mid grasses and scattered motts of live oak and hackberry trees. Major management concerns include proper grazing use, which includes adequate rest periods, and brush management.

Potential for small grain is medium. Potential for sorghum is low. Crop residue left on the surface helps conserve moisture, control erosion, and maintain soil productivity. Potential for pasture grasses is low; Kleingrass and King Ranch bluestem are adapted to this soil.

Potential for most urban uses is medium; however, shallow depth to bedrock is a concern where excavation is required for installation of structures or utilities. Capability subclass IIIe; Shallow range site.

PuC—Purves clay, 3 to 5 percent slopes. This shallow, well drained, gently sloping, clayey soil is on uplands. Slopes are plane to convex. Areas are irregularly shaped and range from 5 to 100 acres.

The surface layer is dark grayish brown, calcareous clay about 14 inches thick. Below that is hard limestone.

This soil has high organic matter content. Permeability is moderately slow, and available water capacity is very low. The soil can be worked best under a narrow range of moisture conditions. Tillage needs to be timely and limited. The root zone is shallow but easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Bolar and Brackett soils. Bolar soils are on the lower parts of slopes, and Brackett soils are usually on the upper parts of convex slopes. Areas of these included soils are each less than 5 acres and together make up less than 20 percent of any mapped area.

This soil is mostly used as rangeland. Potential for native range plants is medium. The climax plant community is an open prairie of tall and mid grasses and scattered live oak and hackberry trees. Management concerns include proper grazing use, which includes adequate rest periods, and brush management.

Potential for such crops as small grain is medium. Potential for sorghum is low. Slope and the shallow root zone affect use of the soil. Potential for pasture grasses is low; Kleingrass and King Ranch bluestem are adapted to this soil.

Potential for most urban uses is medium; however, shallow depth to bedrock is a concern where excavation is required for installation of structures or utilities. Capability subclass IVe; Shallow range site.

PvG—Purves-Tarrant complex, 8 to 40 percent slopes. This is a complex of shallow, well drained, strongly sloping to steep, stony soils. Limestone fragments, 6 to 20 inches in diameter, cover 5 to 20 percent of the surface. Slope ranges from 8 to 40 percent, but is dominantly about 15 percent. Areas are long, and narrow and are weakly benched. They range from 50 to 500 acres.

About 40 percent of this complex is Purves soils, 30 percent is Tarrant soils, and 30 percent is other soils and Rock outcrop.

Purves soils dominate the complex. The other soils are in patterns so intricately mixed or so small that they cannot be shown separately at the scale mapped. Tarrant soils are on the upper parts of slopes and on the lips of benches.

Purves soils have a surface layer of dark grayish brown, calcareous, stony clay to a depth of 6 inches and very dark grayish brown, calcareous, gravelly clay to a depth of 16 inches. Below that is hard limestone bedrock.

Purves soils are high in organic matter content. Permeability is moderately slow, and available water capacity is very low. The root zone is shallow over rock but easily penerated by plant roots. The hazard of water erosion is severe, and the hazard of soil blowing is slight.

Tarrant soils have a surface layer about 16 inches thick. The upper 4 inches is very dark grayish brown, calcareous, cobbly clay in which limestone fragments 6 to 20 inches in diameter make up about 20 percent of the horizon, and the lower 12 inches is dark grayish brown, calcareous very cobbly clay in which limestone fragments 6 to 20 inches in diameter make up about 60 percent of the horizon. Below a depth of 16 inches is hard, fractured limestone bedrock.

Tarrant soils are high in organic matter content. Permeability is moderately slow, and available water capacity is very low. The root zone is shallow over rock but easily penetrated by plant roots. The hazard of water erosion is severe, and the hazard of soil blowing is slight.

Included with these soils in mapping are small areas of Bolar and Brackett soils. Brackett soils are on the upper parts of slopes, and Bolar soils are on the lower parts of foot slopes. Also included is a soil that is similar to Purves soils except that it is more loamy. Areas of these included soils are less than 20 acres and make up less than 20 percent of any mapped area.

This complex is used as rangeland or wildlife habitat and is better suited to these uses than to any other. Potential for native range plants is medium. The climax plant community is a mixture of tall and mid grasses and scattered woody plants. Generally, there is a distinct variation between the composition of the vegetation on north-facing and south-facing slopes. North-facing slopes support a more dense canopy of vegetation because they receive less direct sunlight. Major management concerns include proper grazing use, which includes adequate rest periods, and brush management. Potential for wildlife habitat is medium; browse and cover provide favorable habitat for deer.

Potential for crops, pasture, and urban uses is low. The steepness of slopes, stones, and shallow depth to bedrock are very difficult to overcome. These limitations, however, are occasionally overcome by special design or by modification of the site so the scenic view can be part of urban development. Capability subclass VIIs; Purves soil in Shallow range site, Tarrant soil in Steep Rocky range site.

PXD—Purves-Bolar association, undulating. This association consists of undulating, stony soils on uplands. These soils have a slight "stairstep," or smoothly rolling, topography. Limestone fragments 6 to 30 inches in diameter cover 1 to 20 percent of the surface. Slopes range from 1 to 8 percent. Areas are broad and irregularly shaped and range from 10 to 2,000 acres, but average about 500 acres.

About 50 percent of this association is Purves soils, about 25 percent is Bolar soils, and about 25 percent is other soils and Rock outcrop.

Purves soils dominate the association. They are on plane to convex slopes and are in narrow strips between bands of the deeper Bolar soils. Some areas of Purves and Bolar soils are large enough to separate at the scale of mapping used, but since use and management are similar, separate mapping was not justified.

Purves soils have a surface layer of dark grayish brown, calcareous stony clay to a depth of 6 inches and dark grayish brown, calcareous gravelly clay to a depth of 18 inches. Below that is hard, white limestone bedrock.

Purves soils have high natural fertility and high organic matter content. Permeability is moderately slow, and available water capacity is very low. The root zone is restricted because the soil is shallow over rock. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Bolar soils have a surface layer of dark grayish brown, calcareous stony clay loam about 18 inches thick. The subsoil is pale brown, calcareous clay loam to a depth of 26 inches and light yellowish brown, calcareous clay loam to a depth of 36 inches. Below that is hard limestone (fig. 11).

Bolar soils are productive and have high organic matter content. Permeability is moderate, and available water capacity is medium. The root zone is moderately deep and easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with these soils in mapping are small areas of Brackett, Tarrant, Denton, and Lewisville soils. Brackett and Tarrant soils are on high knolls, and Denton and Lewisville soils are on foot slopes or near drainageways. Also included are a few areas of a soil that is similar to Purves soils except that it is lighter colored and more loamy. A soil that is similar to Purves soils except that it has many limestone fragments and is less clayey is also included. Areas of these included soils are less than 30 acres and together make up less than 20 percent of any mapped area.

This association is used as rangeland, and it has medium potential for native range plants. The climax plant community is a mixture of tall and mid grasses and a few motts of live oak. Management concerns include proper stocking, controlled grazing, and brush management.

This association has low potential for crops or pasture grasses. The shallow root zone and stones in the surface layer make these soils better suited as rangeland than for other uses.

Potential for urban uses is medium. Large stones on the surface, shallow depth to rock, and slopes need to be overcome in the installation of structures or utilities. Capability subclass VIs; Purves soil in Shallow range site, Bolar soil in Clay Loam range site.

SuC—Sunev clay loam, 3 to 5 percent slopes. This deep, well drained, gently sloping, loamy soil is in convex areas on foot slopes. Areas are irregularly shaped and range from 5 to 50 acres.

The surface layer is dark grayish brown, calcareous clay loam about 16 inches thick. The subsoil is light yellowish brown, calcareous clay loam to a depth of 28 inches and reddish yellow, calcareous clay loam to a depth of 44 inches. The subsoil contains numerous concretions, films, and threads of calcium carbonate. The underlying material, to a depth of 60 inches or more, is very pale brown, calcareous fine sandy loam.

This soil is high in organic matter content. Permeability is moderate, and available water capacity is medium. Tilth is good. The root zone is deep and easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Brackett, Karnes, and Lewisville soils. The shallow Brackett soils are usually on the upper parts of slopes, Karnes soils are usually on the middle parts of slopes, and Lewisville soils are on the lower parts of slopes near drainageways. Areas of these included soils are less than 5 acres and together make up less than 20 percent of any mapped area.

This soil is mostly used as rangeland, and potential for native range plants is high. The climax plant community is an open prairie that supports an abundant growth of tall and mid grasses. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential for crops such as grain sorghum and small grain is medium. The high lime content of the lower layers makes some plant nutrients unavailable and reduces yields in some years. Terraces and contour cultivation help reduce erosion. Crop residue left on the surface helps reduce erosion, conserve moisture, and maintain soil productivity. Potential for pasture grasses is medium; Kleingrass is well suited to this soil.

Potential for most urban uses is high. Capability subclass IIIe; Clay Loam range site.

SuD—Sunev clay loam, 5 to 8 percent slopes. This deep, well drained, sloping, loamy soil is in convex areas on foot slopes. Areas are irregularly shaped and range from 5 to 150 acres, but are dominantly about 20 acres.

The surface layer is very dark grayish brown, calcareous clay loam about 18 inches thick. The subsoil is brown, calcareous clay loam about 8 inches thick. Below this, and extending to a depth of 60 inches or more, is pale brown, calcareous clay loam that contains numerous concretions and soft bodies of calcium carbonate.

This soil has a high organic matter content. Permeability is moderate, and available water capacity is medium. Tilth is good. The root zone is deep and easily penetrated by plant roots. The hazard of water erosion is severe, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Brackett and Karnes soils. Both of these soils are lighter colored than Sunev soils and are on the upper parts of slopes. Areas of these soils are less than 5 acres and together make up less than 20 percent of any mapped area.

This soil is mostly used as rangeland, and potential for native range plants is high. The climax plant community is an open prairie that supports an abundant growth of tall and mid grasses. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential as cropland is low because of slope. Close-sown forage sorghum and small grain are grown in some areas. Terraces, diversions, and crop residue management help control erosion, conserve moisture, and maintain soil productivity. Potential for pasture grasses is medium; Kleingrass is suited to this soil.

Potential for most urban uses is high. Capability subclass IVe; Clay Loam range site.

TAD—Tarrant association, undulating. These shallow, well drained, undulating, stony soils are on ridgetops. Slope ranges from 1 to 8 percent. Areas are irregularly shaped and range from 10 to several hundred acres, but average about 75 acres. Limestone fragments from 6 to 36 inches in diameter cover from 3 to 60 percent of the surface.

About 68 percent of this association is Tarrant soils, and about 32 percent is other soils and Rock outcrop.

Tarrant soils dominate the association. They make up from 50 to 90 percent of the mapped acreage. They are on plane to convex slopes and have a surface layer of stony clay or cobbly clay. Some of the other soils are shallow and have reddish brown horizons; these soils are near the centers of the broad ridges. Also included are moderately deep soils on concave surfaces along drainageways. Some areas of the other soils are large enough to be separated at the scale of mapping used, but since use and management are similar, separate mapping was not justified.

Tarrant soils have a surface layer of very dark grayish brown, calcareous cobbly clay about 16 inches thick. The upper 4 inches is about 20 percent and the lower 12 inches about 60 percent, by volume, limestone fragments. Below a depth of 16 inches is coarsely fractured limestone bedrock.

These soils are high in organic matter content. Permeability is moderately slow, and available water capacity is very low. The root zone is restricted because the soil is shallow over rock. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with these soils in mapping are small areas of Bosque, Denton, Lewisville, and Sunev soils. Bosque soils are along flood plains, Denton soils are on plane slopes on wide mesas, and Lewisville and Sunev soils are near drainageways or along foot slopes. Areas of these included soils are less than 20 acres and together make up less than 20 percent of any mapped area.

These soils are used as rangeland (fig. 12), but potential for native range plants is low. These soils, however, are better suited to rangeland than for other uses. The climax plant community is an open prairie of tall and mid grasses and scattered live oaks. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management. Potential for wildlife habitat is medium; food and cover provide favorable habitat for deer.

Potential for crops, pasture, and urban uses is low. The large stones on the surface and the shallow depth over bedrock are very difficult to overcome. Capability subclass VIIs; Low Stony Hill range site.

TAF—Tarrant-Rock outcrop association, hilly. This association is made up of stony soils (fig. 13). Limestone fragments from 3 to 30 inches in diameter cover from 5 to 20 percent of the surface. Slope is about 10 to 30 percent, but is dominantly about 18 percent. Areas are usually long and narrow and range from 20 to 300 acres.

Tarrant soils make up 50 to 70 percent of the map unit, Rock outcrop makes up about 15 percent, and less extensive soils make up the rest. These less extensive soils are less clayey than Tarrant soils or are deeper to limestone or marl. Some areas of these other soils are large enough to separate at the scale of mapping used, but since use and management are similar, separate mapping was not justified.

Tarrant soils have a surface layer of very dark grayish brown, calcareous cobbly clay about 10 inches thick. Limestone fragments make up about 40 percent of the horizon in the upper 4 inches and about 70 percent in the lower 6 inches. Below this is fractured limestone bedrock.

These soils are high in organic matter content, Permeability is moderately slow, and available water capacity is very low. The root zone is restricted because the soil is shallow over rock. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Rock outcrop is exposed strata of limestone bedrock along the slopes. Tarrant soils and the less extensive soils are between the strata, which vary in thickness from 1 to 4 feet. Areas of Rock outcrop are mostly bare rock, although in places lichens and mosses grow along cracks in the limestone or under ledges.

Included with these soils in mapping are small areas of Brackett and Karnes soils. Brackett soils are on sharp breaks or high knolls and usually have a southern exposure; Karnes soils are usually along drainageways between the hills. Areas of these included soils are less than 30 acres and together make up less than 30 percent of any mapped area; no included soil by itself makes up more than 20 percent of any mapped area.

This association is used as rangeland, but potential for native range plants is low. These areas, however, are better suited as rangeland than for other uses. The climax plant community is a savannah of tall and mid grasses and an overstory of Texas oak and live oak trees. Management concerns include proper grazing use, which includes adequate rest periods, and brush management. Potential for wildlife habitat is medium; adequate food and cover provide favorable habitat for deer and turkey.

Potential for crops, pasture, and urban uses is low. The steep slopes, Rock outcrop, and stones are very difficult to overcome. Capability subclass VIIs; Steep Rocky range site.

TrA—Thurber clay loam, 0 to 1 percent slopes. This deep, moderately well drained, nearly level, loamy soil is in broad areas on uplands. Areas are irregularly shaped to oval and range from 5 to 150 acres, but are dominantly about 30 acres.

The surface layer is brown, neutral clay loam about 6 inches thick. The subsoil is very dark grayish brown, neutral clay to a depth of 24 inches; dark grayish brown, moderately alkaline clay to a depth of 32 inches; and grayish brown, calcareous clay to a depth of 48 inches. The underlying material, to a depth of 64 inches or more, is grayish brown, calcareous clay.

This soil is very slowly permeable and has medium available water capacity. Runoff is high. Tilth is poor. The surface layer is very hard and massive when dry. It can be worked only in a narrow range of moisture conditions. The root zone is deep, but penetration of plant roots is restricted by the dense clay lower layers. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Hassee and Leeray soils. Hassee soils are somewhat poorly drained and are usually in areas of less than 5 acres, and Leeray soils are in positions similar to those of Thurber soils, but have deep cracks at the surface and gilgai microrelief. Areas of these included soils are less than 10 acres and together make up less than 20 percent of any mapped area.

This soil is used mainly as rangeland, and potential for native range plants is medium. The climax plant community is an open prairie of mid and short grasses. Management concerns include proper grazing use, which includes adequate rest periods, and brush management.

The soil is droughty; therefore, potential for summer crops, such as sorghum, is low. Potential for cool-season crops such as small grains is medium. Crop residue left on the surface helps conserve moisture and improve tilth. Potential for pasture grasses is low; King Ranch bluestem is adapted to this soil.

Potential for most urban uses is low. High shrink-swell potential, high runoff, and very slow water intake rate are difficult to overcome. Capability subclass IIIs; Claypan Prairie range site.

TrB—Thurber clay loam, 1 to 3 percent slopes. This deep, moderately well drained, gently sloping, loamy soil is in broad areas on uplands. Areas are irregularly shaped and range from 15 to 150 acres, but are dominantly about 40 acres.

The surface layer is brown, neutral clay loam about 8 inches thick. The subsoil is dark grayish brown, neutral clay to a depth of 26 inches; brown, moderately alkaline clay that contains a few concretions of calcium carbonate to a depth of 36 inches; and brown, calcareous clay to a depth of 50 inches. The underlying material, to a depth of 64 inches or more, is yellowish brown, calcareous clay.

This soil is very slowly permeable. Available water capacity is medium. Runoff is high. Tilth is poor. The surface layer is very hard and massive when dry. It can be worked only in a narrow range of moisture conditions.

The root zone is deep, but penetration of plant roots is restricted by the dense clay lower layers. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Hassee and Leeray soils. Hassee soils are somewhat poorly drained, and Leeray soils are in positions similar to those of Thurber soils, but have gilgai microrelief. Areas of these included soils are less than 15 acres and together make up less than 15 percent of any one mapped area.

This soil is used mainly as rangeland. Potential for native range plants is medium. The climax plant community is an open prairie of mid and short grasses. Management concerns are proper grazing use, which includes adequate rest periods, and brush management.

The soil is droughty. Potential for summer crops, such as sorghum, is low; potential for cool-season crops, such as small grain, is medium. Terraces, contour cultivation, and crop residue left on the surface help control erosion and maintain soil productivity and tilth. Potential for pasture grasses is low; King Ranch bluestem is adapted to this soil.

Potential for most urban uses is low. High shrink-swell potential, high runoff, and very slow water intake rate are difficult to overcome. Capability subclass IIIe; Claypan Prairie range site.

TuB—Truce fine sandy loam, 1 to 3 percent slopes. This deep, well drained, gently sloping, loamy soil is in erosional areas on uplands. Slopes are convex. Areas are irregularly shaped and range from 10 to 100 acres, but average about 25 acres.

The surface layer is brown, slightly acid fine sandy loam about 3 inches thick. The subsurface layer is pale brown, slightly acid fine sandy loam that extends to a depth of 5 inches. The subsoil is yellowish red, neutral clay to a depth of 12 inches; brown, neutral clay to a depth of 30 inches; and yellowish brown, calcareous clay to a depth of 48 inches. The underlying material, to a depth of 60 inches or more, is olive yellow shaly clay.

This soil is slowly permeable. Available water capacity is medium. Tilth is poor. The surface layer is very hard when dry and difficult to work. The root zone is deep, but the clayey lower layers restrict plant root penetration. The hazards of water erosion and soil blowing are moderate.

Included with this soil in mapping are small areas of Bonti and Owens soils. Bonti soils are on ridgetops and have plane surfaces, and Owens soils are on slight knolls. Rock outcrop is included in some areas. Areas of these included soils are less than 10 acres and together make up less than 15 percent of any mapped area.

This soil is used mainly as rangeland. Potential for native range plants is medium. The climax plant community is a mixture of mid and short grasses and forbs. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential for such crops as oats and sorghum is medium. Forage sorghum is the major crop. Terraces, contour cultivation, and crop residue management help control erosion and maintain productivity. Timely and limited cultivation are needed. Potential for pasture grasses, such as bermudagrass, is low. King Ranch bluestem is adapted to this soil.

Potential for most urban uses is medium. Moderate shrink-swell potential, slow water intake rate, and low strength can be overcome by proper design and installation procedures. Capability subclass IIe; Tight Sandy Loam range site.

TuC2—Truce fine sandy loam, 1 to 5 percent slopes, eroded. This deep, well drained, gently sloping, loamy soil is in convex areas on uplands. Water erosion has removed about 75 percent of the original surface layer; there are a few shallow gullies, about 6 inches deep and 24 inches wide. Areas are irregularly shaped and range from 5 to 30 acres, but are dominantly about 15 acres.

The surface layer is yellowish brown, neutral fine sandy loam about 3 inches thick. The subsoil is reddish brown, neutral clay to a depth of 18 inches; brown, neutral clay to a depth of 24 inches; and yellowish brown, neutral clay to a depth of 44 inches. The underlying material, to a depth of 62 inches or more, is pale olive, calcareous shale.

This soil is slowly permeable and has medium available water capacity. The surface layer is very hard when dry and is difficult to work. The root zone is deep, but the clayey lower layers restrict penetration of plant roots. The hazards of water erosion and soil blowing are moderate.

Included with this soil in mapping are small areas of Owens, Bonti, and Pedernales soils. Owens soils are usually on low knolls; Bonti soils are generally on ridgetops and have a plane surface; and Pedernales soils are in positions similar to those of Truce soils, but formed over limy layers. Areas of these included soils are less than 5 acres and together make up less than 20 percent of any mapped area.

This soil is used mostly as rangeland, and potential for native range plants is medium. The climax plant community is a mixture of mid and short grasses and forbs. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential for crops is low, but forage sorghum is grown in a few areas. Terraces, contour cultivation, and crop residue management help reduce erosion, conserve moisture, and maintain productivity. Potential for pasture grasses, such as bermudagrass, is low; King Ranch bluestem is adapted to this soil.

Potential for most urban uses is medium. Medium shrink-swell potential, slow water intake rate, and low strength can be overcome by proper design and careful installation procedures. Capability subclass IIIe; Tight Sandy Loam range site.

TxD—Truce-Bonti complex, 1 to 8 percent slopes. This complex consists of gently sloping to sloping, stony soils on uplands. Sandstone fragments from 6 to 36 inches in diameter cover from 1 to 20 percent of the surface. Areas are on irregularly shaped to elongated ridges and breaks along drainageways. They range from 10 to 400 acres.

About 47 percent of this map unit is Truce stony fine sandy loam, 37 percent is Bonti stony fine sandy loam, and 16 percent is other soils and Rock outcrop.

Truce soils dominate the complex. The other soils are in patterns so intricately mixed that separation is not practical at the scale mapped. Bonti soils are in irregular areas on the lower parts of slopes and on ridgetops.

Truce soils have a surface layer of brown, slightly acid stony fine sandy loam about 4 inches thick. The subsurface layer is very pale brown, neutral fine sandy loam that extends to a depth of 6 inches. The subsoil is yellowish red, neutral clay to a depth of 16 inches; reddish yellow, neutral clay to a depth of 30 inches; and light yellowish brown, neutral clay to a depth of 44 inches. The underlying material, to a depth of 62 inches or more, is light gray, calcareous shale.

Truce soils are slowly permeable. Available water capacity is medium. The surface layer is very hard when dry. The root zone is deep, but penetration of plant roots is restricted by the clay lower layers. The hazards of water erosion and soil blowing are moderate.

Bonti soils have a surface layer of brown, slightly acid stony fine sandy loam to a depth of 4 inches and pale brown, medium acid fine sandy loam to a depth of 5 inches. The subsoil is yellowish red, medium acid sandy clay that extends to a depth of 28 inches. Below that is strongly cemented sandstone.

Bonti soils are moderately slowly permeable. Available water capacity is medium. The root zone is moderately deep, and plant roots are restricted by the clayey lower layers. The hazards of water erosion and soil blowing are moderate.

Included with these soils in mapping are small areas of Owens soils, Rock outcrop, and a soil that is similar to Bonti soils except that the underlying sandstone is less than 20 inches below the surface. Owens soils and Rock outcrop are usually near the upper part of the slope. The soil that is similar to Bonti soils is usually on the tops of ridges. Areas of these included soils are less than 20 acres and make up less than 20 percent of any mapped area.

This complex is used as rangeland, and potential for native range plants is medium. The climax plant community is an open savannah of post oak trees and an understory of tall, mid, and short grasses. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management. Potential for wildlife habitat is high; areas of this soil provide food and cover for deer and quail.

Potential is low for crops and pasture and for urban uses. Stones on the surface are the major limitations, and they are difficult to remove. Capability subclass VIs; Truce soil in Tight Sandy Loam range site, Bonti soil in Sandy Loam range site.

TyF—Truce-Rock outcrop complex, 8 to 20 percent slopes. This complex consists of stony, strongly sloping to moderately steep soils on ridges. Sandstone fragments, 1 to 4 feet in diameter, cover 5 to 20 percent of the surface. Areas are elongated to irregularly shaped, are on ridges, and range from 10 to 200 acres.

About 53 percent of this map unit is Truce soils, 17 percent is Rock outcrop, and 30 percent is other soils.

Truce soils dominate the complex. Rock outcrop and other soils are in patterns so intricately mixed or so small that they cannot be shown separately at the scale mapped. The other soils are similar to Truce soils, but are underlain by sandstone or have a more clayey surface layer.

Truce soils have a surface layer of brown, slightly acid stony fine sandy loam about 4 inches thick. The subsurface layer is light yellowish brown stony fine sandy loam that extends to a depth of 6 inches. The subsoil is yellowish red, neutral clay to a depth of 24 inches; reddish yellow, neutral clay to a depth of 36 inches; and olive yellow, neutral clay to a depth of 42 inches. The underlying material, to a depth of 64 inches or more, is olive yellow, calcareous shale.

Truce soils are slowly permeable. Available water capacity is medium. The surface layer is very hard and crusty when dry. The root zone is deep, but penetration of plant roots is restricted by the clayey lower layers. The hazard of water erosion is severe, and the hazard of soil blowing is slight.

Rock outcrop is bands of sandstone bedrock exposed at the surface of the slope at irregular intervals. Truce soils and the less extensive soils are between these strata, which range in thickness from 1 to 4 feet. Areas of Rock outcrop are mostly bare rock, although in places lichens and mosses grow along cracks in the sandstone or below ledges. Some plant roots are able to penetrate to soil between the outcrops of sandstone.

Included with this soil in mapping are small areas of Owens soils in midslope positions, generally facing south. Areas of this included soil are generally less than 10 acres and make up less than 15 percent of any mapped area.

This complex is used as rangeland. Potential for native range plants is medium. The climax plant community is an open stand of post oak trees and an understory of tall and mid grasses. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management. Potential for wildlife habitat is high; adequate food and cover provide favorable habitat for deer and turkey.

Potential is low for crops and pasture and for urban uses. The limitations of stones on the surface and slope are very difficult to overcome. Capability subclass VIIs; Sandstone Hills range site.

VeB—Venus loam, 1 to 3 percent slopes. This deep, well drained, gently sloping, loamy soil is on stream terraces adjacent to flood plains. Areas are long and narrow. They range from 5 to 100 acres, but are dominantly about 30 acres.

The surface layer is dark grayish brown, calcareous loam about 12 inches thick. The subsoil is brown, calcareous loam to a depth of 20 inches; pale brown, calcareous loam to a depth of 30 inches; and light yellowish brown, calcareous loam to a depth of 44 inches. The underlying material, to a depth of 62 inches or more, is light yellowish brown, calcareous gravelly loam.

This soil is productive. Organic matter content is high. Permeability is moderate, and available water capacity is high. This soil has good tilth and can be worked during a wide range of moisture conditions. The root zone is deep and easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Bosque, Karnes, and Lewisville soils. Bosque soils are along flood plains, Karnes soils are along the upper parts of slopes or on convex knolls, and Lewisville soils are generally at lower elevations adjacent to flood plains. Areas of these included soils are less than 5 acres and together make up less than 20 percent of any mapped area.

This soil is mostly used as cropland. Potential for crops is high. Sorghum, corn, truck crops, and small grain are suited to this soil. Terraces, contour cultivation, and crop residue management help reduce erosion, conserve moisture, and maintain productivity. Potential for pasture grasses is high; bermudagrass and Kleingrass are well suited to this soil.

Potential for native range plants is high. The climax plant community is an open prairie that supports an abundant growth of tall and mid grasses. Major management concerns are proper grazing use, which includes adequate rest periods, and brush management.

Potential for most urban uses is high. Capability subclass IIe; Clay Loam range site.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture and rangeland, and as sites for buildings, highways and other transportation systems, sanitary facilities, parks and other recreation facilities, and wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; the land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the needed management practices. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

About 317,000 acres in the survey area is used for crops and pasture. Of this total, about 58,000 acres is used for peanuts; 28,000 acres, for sorghum; 28,000 acres, for wheat, oats, and barley; 1,000 acres, for other crops; and the rest, for pasture.

The potential of the soils in Comanche County for increased production of food is high. About 440,000 acres is arable land, of which about 115,000 acres is being farmed.

Of the 440,000 acres of arable land, about 36,000 acres has a clayey surface texture, 200,000 acres has a loamy surface texture, and 204,000 acres has a sandy surface texture. In addition to the reserve productive capacity represented by this land, food production could also be increased considerably by extending the latest crop production technology to all cropland in the county. This soil survey can facilitate the application of such technology.

The use of this soil survey to help make land use decisions that will influence the future role of farming in the county is discussed in the section, "General soil map for broad land use planning."

Soil erosion is the major soil concern in Comanche County. If the clayey and loamy soils in cultivated areas have slopes of more than 1 percent, water erosion is a hazard. Bolar, Bonti, Denton, Karnes, and Truce soils, for example, have slopes of more than 1 percent.

If the soil has a sandy surface texture, soil blowing is a hazard. Chaney, Cisco, Demona, Heaton, Nimrod, and Patilo soils, for example, have sandy surface texture and are susceptible to soil blowing.

Loss of the surface layer through water erosion or soil blowing is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the lower layer is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils with a clayey lower layer, such as Chaney, Pedernales, and Truce soils, and on soils with a layer of rock that limits the depth of the root zone, such as Hensley and Purves soils. Second, soil erosion on farmland results in sedimentation of streams and rivers. Control of erosion minimizes sedimentation and improves the quality of water for municipal use, for recreation and for fish and wildlife.

Erosion control practices provide protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for extended periods can hold soil erosion to amounts that retain the productive capacity of the soils. Minimizing tillage and leaving crop residue on the surface help increase infiltration and reduce the hazard of erosion. These practices can be adapted to most soils in the survey area.

Terraces and diversions reduce the length of slope and reduce erosion. They are more practical on deep, well drained soils that have regular slopes. Krum, Leeray, and in some areas Bastrop soils are suitable for terraces. The other soils are less suitable for terraces and diversions because of irregular slopes or bedrock at a depth of less than 40 inches.

Contour farming is a widespread erosion control practice in the survey area. It is best suited to soils with smooth, uniform slopes.

Soil blowing can damage the sandy soils in a few hours if winds are strong and the soils are dry and bare of vegetation. Maintaining vegetative cover minimizes soil blowing on these soils. Cover cropping, wind stripcropping, and return of plant residues are effective in reducing soil blowing.

Soil fertility is naturally low in most sandy or loamy, light colored soils on uplands of the survey area. They are mainly acid to neutral, and crops respond readily to commercial fertilizers. The soils on flood plains, such as Bosque, Deleon, Energy, Frio, and Lamkin soils, are alkaline and naturally higher in plant nutrients than most soils on uplands. The dark, alkaline soils on uplands, such as Denton, Krum, Lewisville, and Venus soils, are naturally high in plant nutrients, but in places the limy soils hold some plant nutrients in forms unavailable for plant use.

On all soils, additions of fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer to apply.

Field crops suited to the soils and climate of the survey area include many that are not now commonly grown. Peanuts and sorghums are the major row crops, but soybeans, potatoes, sunflowers, guar, alfalfa, and peas can be grown if economic conditions are favorable. Wheat, oats, and rye are the common close-growing crops.

Special crops grown commercially are watermelons, cantaloupes, peaches, and pecans. Large areas can be adapted to special crops such as onions, peppers, radishes, grapes, and apples if economic conditions are favorable. Peaches and pecans are the most important tree fruits and nuts grown in the county.

The sandy soils of the survey area, especially those for which supplemental irrigation is available, are well suited to most specialty crops. Peaches grow best on well drained, sandy soils on uplands, and pecans grow best on moderately well drained, sandy soils on uplands or on the flood plains of the major streams.

Latest information and suggestions for growing special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

The use of the soils for pasture grasses is an important land use in Comanche County. Most operating units, especially those in the sandy areas of the county, use a substantial part of the unit as pastureland. The major pasture grasses in the survey area include improved bermudagrass, lovegrass, and Kleingrass. Fertilization, rotation grazing, proper stocking rate, weed control, and an adequate stock water supply are required for proper pasture management. Pastureland is beneficial for uses other than grazing by livestock. Water erosion and soil blowing, the main hazards in areas used as cropland, are controlled adequately by a cover of pasture grasses.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 3. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil or that a given crop is not commonly irrigated.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Pasture yields were estimated for the most productive varieties of grasses climatically suited to the area and the soil. A few farmers may be obtaining average yields higher than those shown in table 3.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown; that good quality irrigation water is uniformly applied in proper amounts as needed; and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of the soils for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 3 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland or for engineering purposes.

In the capability system, as used in this county, all kinds of soil are grouped at two levels: capability class, subclass, and unit. These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use; they are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms have limitations that nearly preclude their use for commercial crop production.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability subclass is identified in the description of each soil map unit in the section "Soil maps for detailed planning."

Rangeland

STANLEY L. ELLISON, range conservationist, Soil Conservation Service, prepared this section.

About 290,000 acres, or 47 percent of the agricultural land in Comanche County, is rangeland. It is used for the production of native vegetation that is grazed by domestic stock and wildlife.

The raising of livestock is important in the survey area. Most such enterprises are cow-calf, but many operations supplement with winter stockers or carryover calves. Most ranching operations include cropland and pastureland. The major crops—small grain, sorghum, and johnsongrass—are used for supplemental grazing or are stored as hay. Pasture grasses planted for grazing include Coastal bermudagrass, Kleingrass, and lovegrass. Some pastureland is irrigated.

Rangeland soils vary throughout the county from shallow, clayey soils to deep, sandy soils. The native (climax) vegetation varies from short grasses on the shallow clayey soils to tall grasses on deep, sandy soils. Woody plants grow on all rangeland soils.

Where climate and topography are about the same, differences in the kind and amount of vegetation that rangeland can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 4 shows, for each kind of soil, the name of the range site; the potential production of vegetation in favorable, normal, and unfavorable years; common plant names; and the expected percentage of each species in the composition of the potential natural plant community. Soils not listed cannot support a natural plant community of predominately grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. The following are explanations of column headings in table 4.

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community. Soils that produce a similar kind, amount, and proportion of range plants are grouped into range sites. For those areas where the relationship between soils and vegetation has been established, range sites can be interpreted directly from the soil map. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction and a seasonal high water table are also important.

Potential production refers to the amount of vegetation that can be expected to grow annually on well-managed rangeland that is supporting the potential natural plant community. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year the amount and distribution of precipitation and the temperatures are such that growing conditions are substantially better than average; in a normal year these conditions are about average for the area; in an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry vegetation produced per acre each year by the potential natural plant community. Vegetation that is highly palatable to livestock and vegetation that is unpalatable are included. Some of the vegetation can also be grazed extensively by wildlife.

Common plant names are given for the grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil. Under *Composition*, the expected proportion of each species is presented as the percentage, in air-dry weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season. Generally all of the vegetation produced is not used.

Range management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluaton of the present condition of the range vegetation in relation to its potential. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the maximum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

In the southern part of the county, most of the rangeland soils are stony and shallow over limestone. These soils support an open prairie of tall and mid grasses as original (climax) vegetation. Potential productivity is medium, and the forage is nutritious. In much of the northern part of the county, the soils are deep and sandy. Potential productivity on these deep, sandy soils is greater than on shallower soils, but the nutritive value of the forage is lower.

Because of long-term overgrazing, low-quality vegetation now dominates much of the rangeland in the county. This degraded vegetation includes annuals, buffalograss, threeawns, shinnery oak, and mesquite.

The main concern of stockmen now is to improve and maintain the vigor and productivity of the good forage plants. Management of the time and intensity of grazing in order to permit re-establishment and growth of the natural plant community is essential. This can be done by keeping the number of livestock in balance with the varying forage yields. Other needed conservation practices include brush management and seeding.

If sound range management principles based on soil survey information and range inventories are applied, the potential is high for increasing the productivity of rangeland in the county.

Engineering

LERON E. SATTERWHITE, engineer, Soil Conservation Service, helped prepare this section.

This section provides information about the use of soils for building sites, sanitary facilities, construction materials, and water management. Among those who can benefit from this section are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to: (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 5 shows, for each kind of soil, the degree and kind of limitations for building site development; table 6, for sanitary facilities; and table 8, for water management. Table 7 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 5. A *slight* limitation indicates that soil properties are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are used for pipelines, sewerlines, telephone and power transmission lines, basements, open ditches, and cemetery plots. Such digging or trenching is influenced by the soil wetness of a high seasonal water table, the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is defined, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 5 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious limitation.

Local roads and streets referred to in table 5 have an all-weather surface that can carry light to medium traffic all year. They consist of subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 6 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope may cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table could be installed or the size of the absorption field could be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soils affect the performance of embankments.

Sanitary landfill refers to a method of disposing of solid waste by placing refuse and soil in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with thin layers of soil. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness may be a limitation because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

In the trench type of landfill, ease of excavation also affects the suitability of a soil for this purpose, so the soil must be deep to bedrock and free of large stones and boulders. Where the seasonal water table is high, water seeps into trenches and causes problems in filling.

Unless otherwise stated, the limitations in table 6 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 7 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 11 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low potential frost action, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor.*

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 7 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 11.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slopes, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients; therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 8 the degree of soil limitation and soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Soil and site limitations are expressed as slight, moderate, and severe. *Slight* means that the soil properties and site features are generally favorable for the specified use and that any limitation is minor and easily overcome. *Moderate* means that some soil properties or site features are unfavorable for the specified use but can be overcome or modified by special planning and design. *Severe* means that the soil properties and site features are so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance is required.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Drainage of soil is affected by such soil properties as permeability, texture, depth to bedrock, hardpan, or other layers that affect the rate of water movement, depth to the water table, slope, stability of ditchbanks, susceptibility to flooding, salinity and alkalinity, and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Gardening and landscaping

FLOYD M. KAY, county extension agent, helped prepare this section.

Homeowners who want to landscape their homes need to know what kinds of soil are on their property and what kinds of flowers and ground cover, vines, shrubs, and trees are best suited to their soils. In some areas plants may be needed for erosion control as well as for esthetic purposes.

Soils well suited to yard and garden plants are those that have a deep root zone, a loamy texture, a balanced supply of plant nutrients, plenty of organic matter in various stages of decomposition, adequate available water capacity, good drainage, and a granular structure that allows free movement of water, air, and roots. The degree of acidity or alkalinity suitable for the particular plants to be grown is also important. For example, roses and most annual flowers, most vegetables, and most grasses generally grow best in soils that are neutral (noncalcareous) or only slightly acid. Dahlias, camellias, gardenias, and similar plants need acid soils. Some plants grown on soils that have a high lime content, such as Brackett soils, develop a condition called chlorosis, or yellowing of the leaves. Many flowers, shrubs, and trees, however, are well suited to the limy (calcareous) soils in Comanche County. Some of these flowers are bearded iris, shasta daisies, abelia, babysbreath, petunias, zinnias, and gladiolus. Crapemyrtle, pecan, and fruitless mulberry are some of the shrubs and trees.

Many flowers, vines, shrubs, and trees are native to the area. Native plants should be transplanted only to areas of similar soils. For lists of additional plants suitable for the soils of Comanche County, consult your local nurseryman or county extension agent.

It is generally cheaper and more advisable to condition the native soil than to replace it with manmade soil material. The soil should be tested, and fertility needs should be determined for the plants to be grown. The most important amendment to the soil is organic matter. This may be peanut hulls, peat moss, compost, rotted sawdust, or manure. At least 2 inches of organic matter should be added to the soil. For clayey soils, also add at least 2 inches of sand. These materials should be spaded or rototilled into the top 8 inches of the native soil. If an acid soil is desired, also incorporate 1 to 2 pounds of sulfur. If soil is too acid, it can be neutralized by adding bonemeal, lime, wood ashes, or finely ground limestone.

In some areas of the county, the soils are so clayey or poorly drained that it may be necessary to construct raised beds in order to grow flowers and some shrubs. Brick, tile, metal, cedar, or redwood makes a good retainer along the edge of the bed. The bed should be filled with good soil material and well balanced physical and chemical amendments.

All plants, whether grown in native soil or manmade soil, require careful maintenance, especially during the period of establishment. Good management practices include fertilizing, watering, and controlling weeds and insects.

Gardening and landscaping should be included in the basic planning of home construction. Potential of the native soil for plants should be considered when selecting sites for construction. Erosion can be prevented by timely establishment of ground cover. Also important is the protection of existing trees during construction. In timbered areas, large healthy trees are a valuable and often irreplaceable asset to the property. Many potential landscape trees are killed or damaged beyond restoration because construction crews, supervisors, or property owners are careless in excavation, filling, and construction activities. For guidelines for the protection of existing trees, consult the Soil Conservation Service or the Agricultural Extension Service.

Recreation

EDWARD M. SCHWILLE, biologist, Soil Conservation Service, prepared this section.

About 70 percent of the survey area is suitable for commercial or noncommercial recreational activities. Potential is medium for recreational development.

Lakes Proctor, Eanes, Comanche, and Nabors provide fishing, camping, picnicking, and water-related activities, and many areas suitable for recreation are along the Sabanna and Leon Rivers. Existing water areas are abundant, and they range in size from 20 to 150 acres. White-tailed deer, dove, and bobwhite quail inhabit the area. Limited accessibility reduces the potential for development of natural and scenic areas. Approximately 30 historical markers and sites are located throughout the survey area.

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 6, and interpretations for dwellings without basements and for local roads and streets, given in table 5.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Wildlife habitat

EDWARD M. SCHWILLE, biologist, Soil Conservation Service, prepared this section.

Because of management and manipulation of the habitat, wildlife in the survey area is increasing. Special emphasis is being given to the improvement of habitat for game species.

Major kinds of wildlife habitat in the survey area are those for white-tailed deer, mourning dove, bobwhite quail, turkey, raccoon, opossum, striped skunk, ringtail cat, bobcat, coyote, red and gray fox, armadillo, fox and gray squirrel, and numerous songbirds. During the migration periods, waterfowl, such as northern mallard, pintail, teal, and canvasback ducks, use existing water areas, and fish are abundant. Numerous reptiles and amphibians live in the survey area.

The golden-cheeked warbler is the only creature on the list of threatened and endangered species that lives in the survey area. It lives in mature stands of Ashe juniper.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, inadequate, or inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants (fig. 14).

In table 10, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. Examples are corn, wheat, oats, and barley. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Examples are fescue, lovegrass, clover, and alfalfa. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Examples are bluestem, dropseed, panicum, greenbrier, honeysuckle, western ragweed, Engelmann-daisy, sunflower, and bundleflowers. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Examples are Russian-olive, oaks, pecan, elm, mesquite, and hackberry. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Examples of wetland plants are smartweed, wild millet, and cordgrass and rushes, sedges, and reeds. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control devices in marshes or streams. Examples are waterfowl feeding areas and ponds. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include bobwhite quail, meadowlark, cottontail rabbit, and red fox.

Wetland habitat consists of open, marshy or swampy, shallow-water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, and turtles.

Rangeland habitat consists of areas of wild herbaceous plants, shrubs, and associated trees on range. Wildlife attracted to rangeland include white-tailed deer, red fox, raccoon, tree squirrels, dove, and bobwhite quail.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classification, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present pertinent soil and water features and engineering test data.

Engineering properties

Table 11 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 11 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 11 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested in the survey area, with group index numbers in parentheses, is given in table 14. The estimated classification, without group index numbers, is given in table 11. Also in table 11 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and

Atterburg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted in table 11.

Physical and chemical properties

Table 12 shows estimated values for several soil features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible, but crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except

silty clay loams. These soils are very slightly erodible, and crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible, and crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

Table 13 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep to deep, moderately well drained to well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes is not considered flooding. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding; and information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the soil mapping. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Engineering test data

The results of analyses of engineering properties of several typical soils of the survey area are given in table 14.

The data presented are for soil samples that were collected from carefully selected sites. The soil profiles sampled are typical of the series discussed in the section "Soil series and morphology." The soil samples were analyzed by the Texas Highway Department Testing Laboratory.

The methods used in obtaining the data are listed by code in the next paragraph. Most of the codes, in parentheses, refer to the methods assigned by the American Association of State Highway and Transportation Officials. The codes for shrinkage and Unified classification are those assigned by the American Society for Testing and Materials.

The methods and codes are AASHTO classification (M-145-66); Unified classification (D-2487-69); mechanical analysis (T88-57); liquid limit (T89-60); and plasticity index (T90-56).

Classification of the soils

In this section, the soil series recognized in the survey area are described, the current system of classifying soils is defined, and the soils in the area are classified according to the current system.

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. Then a pedon, a small three-dimensional area of soil typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*5*). Unless otherwise noted, colors described are for dry soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or map units, of each soil series are described in the section "Soil maps for detailed planning."

Abilene series

The Abilene series consists of deep, loamy soils on uplands. These soils are in shallow valleys and formed in ancient alluvium. Slope ranges from 0 to 3 percent, but is dominantly 0.5 to 2 percent.

Typical pedon of Abilene loam, 1 to 3 percent slopes; about 10 miles south on Texas Highway 16 from its intersection with Texas Highway 36 to its intersection with Farm Road 1476; 5.0 miles northeast on Farm Road 1476 to its intersection with county road; 0.9 mile northwest on county road; 36 feet east of county road right-of-way in a cultivated field:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; hard, friable; few fine roots; neutral; clear smooth boundary.

B21t—6 to 22 inches; very dark grayish brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; moderate fine subangular blocky structure; very hard, very firm; few fine roots; few fine pores; distinct continuous clay films on faces of peds; neutral; gradual smooth boundary.

B22t—22 to 34 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; very hard, very firm; few fine roots; few fine pores; distinct continuous clay films; few films and threads and fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B23tca—34 to 48 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium blocky structure; very hard, very firm; few fine roots; few fine pores; common concretions and white powdery bodies of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

Cca—48 to 62 inches; very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; massive; hard, firm; 20 percent by volume calcium carbonate concretions and soft bodies 2 to 10 mm in diameter; calcareous; moderately alkaline.

The solum ranges from 28 to 60 inches in thickness. Soft powdery forms of calcium carbonate are within 10 to 28 inches of the surface. Depth to a calcic horizon is 28 to 60 inches.

The A horizon is brown, dark brown, grayish brown, dark grayish brown, or very dark grayish brown. It is neutral through moderately alkaline.

The B21t and B22t horizons are brown, dark brown, grayish brown, dark grayish brown, or very dark grayish brown. The B23tca horizon is brown, dark grayish brown, grayish brown, light brownish gray, or pale brown. The B2t horizon is clay loam, clay, or silty clay loam.

The Cca horizon is brown, reddish yellow, pink, light brown, pale brown, very pale brown, or light yellowish brown sandy clay loam, clay loam, or silty clay loam.

Bastrop series

The Bastrop series consists of deep, loamy and sandy soils on stream terraces. These soils formed in thick, reddish beds of loamy alluvial sediments. Slope ranges from 0 to 5 percent.

Typical pedon of Bastrop loamy fine sand, 1 to 5 percent slopes; 1.4 miles north from Gustine on blacktop road to Leon River bridge; 0.45 mile north on blacktop road; 0.25 mile east on private lane; 225 feet north in a cultivated field:

Ap—0 to 8 inches; brown (7.5YR 5/4) loamy fine sand, brown (7.5YR 4/4) moist; single grained; slightly hard, friable; few fine roots; slightly acid; clear smooth boundary.

A1—8 to 14 inches; brown (7.5YR 5/4) loamy fine sand, brown (7.5YR 4/4) moist; single grained; slightly hard, friable; few fine roots; slightly acid; clear smooth boundary.

B1t—14 to 24 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate fine subangular blocky structure; hard, firm; common medium roots; common fine and medium pores; few distinct clay films on faces of peds; neutral; gradual wavy boundary.

B21t—24 to 48 inches; yellowish red (5YR 5/8) sandy clay loam, yellowish red (5YR 4/8) moist; moderate fine and medium subangular blocky structure; very hard, firm; common medium roots; common fine and medium pores; few distinct clay films on faces of peds; neutral; gradual wavy boundary.

B22t—48 to 60 inches; strong brown (7.5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate fine and medium subangular blocky structure; very hard, firm; few fine roots; few fine pores; few faint clay films on faces of peds; mildly alkaline; gradual wavy boundary.

B23t—60 to 75 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; weak subangular blocky structure; hard, firm; few fine roots; few fine pores; few patchy clay films on faces of peds; mildly alkaline.

Solum thickness ranges from 60 to about 90 inches. Small pebbles of quartz make up from 0 percent to about 10 percent, by volume, of the solum.

The A horizon is light brownish gray, grayish brown, dark grayish brown, pale brown, light brown, yellowish brown, brown, or reddish brown fine sandy loam or loamy fine sand. It is medium acid, slightly acid, or neutral.

The Bt horizon is reddish brown, red, yellowish red, or reddish yellow, light reddish brown, brown, or strong brown sandy clay loam or clay loam; clay content is about 20 to 30 percent. The B21t horizon is slightly acid or neutral. The B22t horizon is slightly acid through moderately alkaline.

Weakly cemented concretions and soft bodies of calcium carbonate make up about 1 to 5 percent of some pedons below a depth of 60 inches.

Bolar series

The Bolar series consists of moderately deep, loamy soils on uplands. These soils formed in calcareous, loamy sediments over interbedded limestones and clayey marl. Slope ranges from 1 to 8 percent, but is dominantly 3 to 5 percent.

Typical pedon of Bolar clay loam, 3 to 5 percent slopes; 4 miles southeast from Gustine on Texas Highway 36 to its intersection with Farm Road 1702; 3.7 miles southwest on Farm Road 1702; 0.7 mile south on county road; 30 feet east in rangeland:

A11—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak subangular blocky and granular structure; hard, friable; many fine roots; common medium pores; few fine concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

A12—6 to 18 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky and granular structure; hard, friable; many fine roots; common medium pores; few fine concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B21ca—18 to 30 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; moderate fine subangular blocky and granular structure; hard, firm; common fine roots; common fine pores; common fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22ca—30 to 36 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; moderate fine subangular blocky and granular structure; hard, firm; few fine roots; common fine pores; many fine concretions of calcium carbonate; common soft bodies of calcium carbonate and common coarse fragments of limestone; calcareous; moderately alkaline; abrupt smooth boundary.

R—36 to 37 inches; hard limestone, somewhat fractured and interbedded with clayey marl.

The solum is 20 to 40 inches thick. Content of fragments of limestone and concretions of calcium carbonate of gravel to stone size range from a few to 20 percent, by volume. The fragments are scattered throughout the pedon or are discontinuous, broken, remnant stone lines. Calcium carbonate equivalent of the 10- to 40-inch control section is 40 to 75 percent.

The A horizon is grayish brown, dark grayish brown, very dark grayish brown, brown, or dark brown clay loam or stony clay loam.

The B horizon is light brown, brown, pale brown, very pale brown, grayish brown, light brownish gray, light gray, yellowish brown, light yellowish brown, light olive brown, or pale yellow.

The R layer is indurated limestone that is fractured and interbedded with clayey marl or calcareous shale.

Bonti series

The Bonti series consists of moderately deep, loamy soils on uplands. These soils formed in clayey materials over strongly cemented sandstone. Slope ranges from 1 to 8 percent, but is dominantly about 1 to 5 percent.

Typical pedon of Bonti fine sandy loam, 1 to 3 percent slopes; 0.27 mile southeast on Farm Road 1477 from its intersection with Farm Road 587 in Sipe Springs; 1.35 miles east on county road to field entrance gate; 0.5 mile south along field boundary; 528 feet west in a cultivated field:

Ap—0 to 8 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak coarse subangular blocky structure; hard, friable; few fine roots; few fine black concretions; slightly acid; clear smooth boundary.

B21t—8 to 22 inches; red (2.5YR 4/6) sandy clay, dark red (2.5YR 3/6) moist; moderate medium blocky structure; very hard, firm; few fine roots; few fine pores; common clay films on faces of peds; few fine black concretions; medium acid; gradual smooth boundary.

B22t—22 to 34 inches; yellowish red (5YR 5/6) sandy clay, yellowish red (5YR 4/6) moist; few fine distinct dark red mottles and few fine faint reddish yellow mottles; weak medium blocky structure; very hard, firm; few fine roots; few fine pores; common clay films on faces of peds; few flat fragments of sandstone 3 to 6 mm thick; medium acid; abrupt smooth boundary.

R—34 to 36 inches; brownish yellow, strongly cemented, strongly acid sandstone.

Solum thickness and depth to sandstone ranges from 20 to 40 inches. Content of sandstone fragments in the A horizon varies from 0 percent to about 30 percent, by volume, and ranges in size from 1/8 inch to 20 inches in diameter.

Reaction of the A horizon ranges from neutral through medium acid. The A1 horizon is brown, yellowish brown, or dark yellowish brown. The A2 horizon, where present, is brown, pale brown, light yellowish brown, light brown, or reddish yellow. The A horizon is fine sandy loam or stony fine sandy loam.

Coarse fragments make up from 0 to 15 percent, by volume, of the Bt horizon and are mainly less than 3 inches in diameter. The B21t horizon is red, yellowish red, reddish brown, or light reddish brown. The B22t horizon is red, yellowish red, reddish brown, or light reddish brown, and it commonly has a few dark red, reddish yellow, strong brown, or yellowish brown mottles. The B2t horizon is clay loam, sandy clay, or clay and has clay content of 35 to 45 percent. Reaction is medium acid or strongly acid. Base saturation ranges from about 50 to 75 percent.

The underlying sandstone is strongly cemented to indurated.

Bosque series

The Bosque series consists of deep, loamy soils on bottom lands. These soils formed in calcareous, loamy alluvial materials. Slope ranges from 0 to 1 percent.

Typical pedon of Bosque loam, occasionally flooded; about 2 miles west of Gustine on Texas Highway 36 to its junction with Farm Road 1476; 3.5 miles south on Farm Road 1476; 2.2 miles south on a winding county road; 50 feet east in a cultivated field:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky and fine granular structure; hard, friable; many fine roots; common fine pores; calcareous; moderately alkaline; abrupt smooth boundary.

A1—6 to 32 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure parting to moderate fine subangular blocky; hard, slightly firm; many fine roots; common medium pores; few threads and films of calcium carbonate on faces of peds; common worm casts; calcareous; moderately alkaline; diffuse wavy boundary.

B21—32 to 42 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, firm; few fine roots; few fine pores; many films and threads of calcium carbonate; few streaks and worm casts of darker material; calcareous; moderately alkaline; gradual smooth boundary.

B22—42 to 52 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; hard, firm; few fine roots; few fine pores; many films and threads and few fine concretions of calcium carbonate; few streaks of darker material; many tubes and worm casts; calcareous; moderately alkaline; gradual smooth boundary.

B23—52 to 60 inches; very pale brown (10YR 7/3) clay loam, brown (10YR 5/3) moist; weak and moderate, medium subangular blocky structure; hard, firm; few fine roots; few fine pores; many films, threads, and soft bodies of calcium carbonate; calcareous; moderately alkaline.

The average texture of the control section ranges from loam to clay loam, and clay content ranges from 20 to 35 percent. Some pedons contain a few fine siliceous or limestone pebbles. Erratic changes in color in the solum range from 1 to 2 units in value or chroma.

The A horizon is brown, dark brown, grayish brown, dark grayish brown, or very dark grayish brown. The mollic epipedon ranges from 20 to 50 inches in thickness. The A horizon is mildly alkaline or moderately alkaline and calcareous.

The B horizon is light brown, brown, pale brown, very pale brown, grayish brown, light brownish gray, or light yellowish brown loam or clay loam, and it has lenses of fine sandy loam in some pedons. The B horizon is calcareous and moderately alkaline.

Brackett series

The Brackett series consists of shallow, loamy soils on uplands. These soils formed in calcareous, loamy materials over soft limestone interbedded with hard limestone and chalky marl. Slope ranges from 1 to 20, but is dominantly about 3 to 8 percent.

Typical pedon of Brackett gravelly clay loam, in an area of Brackett-Bolar complex, 1 to 5 percent slopes; 9.8 miles west on U.S. Highway 377-67 from its intersection with Texas Highway 16 in Comanche; 1.4 miles south on county road; 0.4 mile east; 1 mile south; 0.5 mile east; and 1 mile south to entrance to private lane; 360 feet east in a cultivated field:

Ap—0 to 4 inches; brown (10YR 5/3) gravelly clay loam, dark brown (10YR 4/3) moist; moderate fine granular and subangular blocky structure; slightly hard, friable; common fine roots; common limestone fragements, 1 to 3 inches in diameter, most of which are on the surface; calcium carbonate equivalent is 50 percent; calcareous; moderately alkaline; clear smooth boundary.

B2—4 to 18 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; moderate fine subangular blocky structure; hard, friable; few fine roots; common fine pores; many fine concretions and soft bodies of calcium carbonate; calcium carbonate equivalent is 47 percent; calcareous; moderately alkaline; gradual smooth boundary.

C—18 to 36 inches; weakly cemented platy limestone thinly interbedded with very pale brown (10YR 8/4) clay loam, very pale brown (10YR 7/4) moist; massive; few fine roots; calcareous; moderately alkaline.

The solum ranges from 10 to 20 inches in thickness. Gravel-sized fragments of limestone or fragments of limestone as much as 6 inches in diameter make up from 20 to 35 percent of the solum. Fragments of limestone from 6 to 30 inches in diameter cover from 1 to 20 percent of the surface. The calcium carbonate equivalent ranges from 40 to 60 percent.

The A horizon is light brownish gray, grayish brown, brown, pale brown, light brownish gray, grayish brown, and light yellowish brown.

The B2 horizon is very pale brown, pale brown, light yellowish brown, brown, pale yellow, or light yellowish brown.

Chaney series

The Chaney series consists of deep, sandy soils on uplands. These soils formed in clayey deposits. Slope ranges from 1 to 8 percent, but is dominantly 1 to 4 percent.

Typical pedon of Chaney loamy sand, 1 to 5 percent slopes; 2.1 miles north on Farm Road 2247 from its intersection with city street in northern part of Comanche; 2.0 miles east and north on county road; 141 feet east in a cultivated field:

Ap—0 to 8 inches; pale brown (10YR 6/3) loamy sand, brown (10YR 5/3) moist; single grained; slightly hard, friable; common fine roots; few rounded pebbles of quartz; neutral; abrupt wavy boundary.

B21t—8 to 20 inches; yellowish red (5YR 5/6) sandy clay, yellowish red (5YR 4/6) moist; common medium distinct red (2.5YR 4/6) and gray (10YR 5/1) mottles; weak medium blocky structure; very hard, very firm; few fine roots; few fine pores; common distinct clay films; slightly acid; gradual smooth boundary.

B22t—20 to 36 inches; mottled red (2.5YR 4/6), yellowish red (5YR 5/6), and light brownish gray (10YR 6/2) sandy clay; weak medium blocky structure; very hard, very firm; few fine roots; few fine pores; common distinct clay films; few fine fragments of chert; slightly acid; gradual smooth boundary.

B3—36 to 48 inches; mottled red (2.5YR 4/6), brownish yellow (10YR 6/6), and grayish brown (10YR 5/2) sandy clay; weak coarse blocky structure; very hard, very firm; few fine roots; few fine pores; few patchy clay films on faces of peds; neutral; gradual smooth boundary.

C—48 to 62 inches; reddish yellow (5YR 6/6) sandy clay, yellowish red (5YR 5/6) moist; few fine faint gray and yellow mottles; massive; moderately alkaline.

The solum is 30 to 50 inches thick.

The A horizon is fine sandy loam, loamy sand, or stony loamy sand. It is 6 to 20 inches thick. Reaction is neutral through medium acid. The A1 horizon is light brown, brown, grayish brown, dark grayish brown, very pale brown, pale brown, or light brownish gray. The A2 horizon is 1 to 3 units of value lighter in color than the A1 horizon.

The B2t horizon is red, dark red, yellowish red, or brownish yellow. It has distinct or prominent red, gray, or brownish mottles, and some pedons have mottled patterns of reds, yellows browns, and grays throughout. It is sandy clay or clay and has clay content of 35 to 50 percent. Reaction is slightly acid or medium acid. The B3 horizon is mottled with brownish yellow, red, grayish brown, pale brown, or gray. It is sandy clay loam or sandy clay.

The C horizon ranges from sandy loam through shaly clay. Some pedons have thin, weakly cemented, discontinuous layers of sandstone in the C horizon. Reaction is medium acid to moderately alkaline. Some pedons contain a few films, threads, or soft bodies of calcium carbonate in the C horizon.

Cisco series

The Cisco series consists of sandy soils in shallow valleys on uplands. These soils formed in loamy, alkaline sediments. Slope ranges from 1 to 5 percent.

Typical pedon of Cisco loamy fine sand, 1 to 5 percent slopes; 3.7 miles east on Texas Highway 36 from its intersection with an unnumbered paved highway in Gustine; 6.6 miles northeast on Farm Road 1702 to its intersection with Farm Road 2823; 0.8 mile northwest on Farm Road 1702 to county road; 0.1 mile west on county road; 0.5 mile south down private lane; 90 feet east in pasture:

A1—0 to 4 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; hard, friable; many fine roots; neutral; clear smooth boundary.

A2—4 to 10 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; single grained; hard, friable; many fine roots; neutral; clear smooth boundary.

B21t—10 to 18 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate fine subangular blocky structure; very hard, firm; few fine roots; few medium pores; few distinct clay films on faces of peds; neutral; gradual smooth boundary.

B22t—18 to 32 inches; yellowish red (5YR 5/8) sandy clay loam, yellowish red (5YR 4/8) moist; weak medium subangular blocky structure; very hard, firm; few fine roots; few fine pores; few thin clay films on faces of peds; neutral; gradual smooth boundary.

B3—32 to 56 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; few fine faint mottles of red and brown; weak coarse subangular blocky structure; very hard, firm; few black concretions; neutral; clear wavy boundary.

Cca—56 to 70 inches; white (10YR 8/2) sandy clay loam, light gray (10YR 7/2) moist; massive; slightly hard, friable; common fine and medium concretions of calcium carbonate; calcareous; moderately alkaline.

Solum thickness ranges from 40 to 70 inches. Within a depth of 60 inches, clay content is reduced more than 20 percent from the maximum. Secondary carbonates are at depths of 36 to 60 inches. Some pedons have a few rounded siliceous pebbles.

The A horizon is brown, dark grayish brown, grayish brown, light brownish gray, strong brown, pale brown, yellowish brown, light yellowish brown, or light brown. Some pedons have an A2 horizon that is 1 or 2 units of value higher than the A1 horizon. The A horizon is slightly acid or neutral.

The B2t horizon is reddish brown, yellowish red, or red sandy clay loam or clay loam and has clay content of about 20 to 35 percent. It is slightly acid or neutral. The B3 horizon is reddish brown, yellowish red, reddish yellow, red, or brown. It has few to many yellowish brown, brown, and red mottles, but some pedons are not mottled. It is sandy clay loam or fine sandy loam. Reaction is slightly acid to mildly alkaline.

The Cca horizon is sandy clay loam, fine sandy loam, or limy earth interbedded with weakly cemented packsand. Reaction is mildly alkaline or moderately alkaline.

Deleon series

The Deleon series consists of deep, clayey soils on bottom lands. These soils formed in calcareous, clayey alluvial sediments. Slope ranges from 0 to 1 percent and is dominantly about 0.5 percent.

Typical pedon of Deleon clay, occasionally flooded; 4 miles east on Texas Highway 36 from its intersection with an unnumbered paved highway in Gustine to its intersection with Farm Road 1702; 0.93 mile north on Farm Road 1702; 100 feet east in a cultivated field:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; strong very fine and fine blocky structure; extremely hard, very firm; many fine roots; many fine pores; vertical cracks as much as 2 inches wide extend to a depth of 24 inches; calcareous; moderately alkaline; clear smooth boundary.

A11—6 to 18 inches; very dark grayish brown (10YR 3/2) clay, very dark brown (10YR 2/2) moist; strong very fine to fine blocky structure; extremely hard, very firm; many fine roots; many fine pores; few worm casts; calcareous; moderately alkaline; clear smooth boundary.

A12—18 to 22 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; strong very fine and fine blocky structure; extremely hard, very firm; few fine roots; few fine pores; few worm casts; calcareous; moderately alkaline; clear smooth boundary.

A13—22 to 36 inches; very dark grayish brown (10YR 3/2) clay, very dark brown (10YR 2/2) moist; strong fine blocky structure; extremely hard, very firm; few fine roots; few fine pores; calcareous; moderately alkaline; gradual smooth boundary.

A14—36 to 48 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; few fine faint dark brown mottles; strong fine blocky structure; extremely hard, very firm; few fine roots; few fine pores; common films and threads of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

A15—48 to 62 inches; dark brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; few fine faint yellowish brown mottles; strong medium blocky structure; extremely hard, very firm; common films and threads of calcium carbonate; calcareous; moderately alkaline.

Solum thickness ranges from 30 inches to more than 60 inches. When the soil is dry, cracks 0.5 inch to 2 inches wide extend to a depth of 20 to 30 inches. Films, threads, or soft bodies of calcium carbonate are at depths of 28 inches to more than 60 inches.

The A horizon is dark grayish brown, very dark grayish brown, or dark brown clay or silty clay, and clay content of the control section ranges from 40 to 55 percent.

The C horizon, where present, is brown, light brown, dark brown, dark grayish brown, very dark grayish brown, and yellowish brown silty clay loam to clay. In places it contains thin strata of loam, clay loam, fine sandy loam, or fine sand at a depth of more than 40 inches. The C horizon is moderately alkaline and calcareous, with or without films and threads of calcium carbonate.

Demona series

The Demona series consists of deep, sandy soils on uplands. These soils formed in loamy or clayey deposits. Slope ranges from 0 to 5 percent, but is dominantly 1 to 2 percent.

Typical pedon of Demona loamy sand, 0 to 5 percent slopes; about 10.5 miles north on Texas Highway 16 from its intersection with U.S. Highway 377-67 in Comanche to its junction with Farm Road 2318; 1.2 miles west on Farm Road 2318; 110 feet north in a cultivated field:

Ap—0 to 6 inches; light yellowish brown (10YR 6/4) loamy sand, yellowish brown (10YR 5/4) moist; single grained; slightly hard, very friable; few fine roots; neutral; clear smooth boundary.

A1—6 to 10 inches; brown (10YR 5/3) loamy sand, dark brown (10YR 4/3) moist; single grained; slightly hard, very friable; few fine roots; neutral; clear smooth boundary.

A2—10 to 36 inches; light brown (7.5YR 6/4) loamy sand, brown (7.5YR 5/4) moist; single grained; slightly hard, very friable; neutral; abrupt wavy boundary.

B21t—36 to 52 inches; brownish yellow (10YR 6/6) sandy clay, yellowish brown (10YR 5/6) moist; common fine and medium distinct mottles of red (2.5YR 4/6) and gray (10YR 6/1); weak coarse blocky structure; very hard, very firm; few fine roots; few fine pores; common distinct clay films on faces of peds; medium acid; gradual smooth boundary.

B22t—52 to 60 inches; red (2.5YR 5/6) sandy clay, red (2.5YR 4/6) moist; common medium distinct mottles of gray (10YR 6/1) and few fine faint mottles of brownish yellow (10YR 6/8); weak coarse blocky structure; very hard, very firm; few fine roots; few fine pores; common distinct clay films on faces of peds; medium acid; gradual smooth boundary.

B3—60 to 74 inches; light red (2.5YR 6/6) sandy clay loam, red (2.5YR 5/6) moist; common medium distinct gray (10YR 6/1) and brownish yellow (10YR 6/6) mottles; weak medium blocky structure; hard, firm; light red coatings on sand grains; slightly acid.

Solum thickness ranges from 50 to 90 inches.

The A horizon is loamy sand and ranges in thickness from 20 to 40 inches. It is light brown, brown, grayish brown, dark grayish brown, light yellowish brown, or very pale brown. Reaction is neutral to mildly alkaline. The A2 horizon is pale brown, very pale brown, light brown, or reddish yellow. Reaction is neutral to medium acid.

The B2t horizon is red, light gray, or brownish yellow and has varying amounts of red, yellow, brown, and gray mottles. The B2t horizon is sandy clay or clay. The B2t horizon ranges from strongly acid to slightly acid. The B3 horizon is red, light gray, light red, brownish yellow, or reddish yellow and has varying amounts of red, yellow, or gray mottles. The B3 horizon is sandy clay loam or sandy clay.

The C horizon is sandy clay loam or sandy clay.

Denton series

The Denton series consists of moderately deep, clayey soils on uplands. These soils formed in calcareous, clayey sediments over indurated limestones and interbedded marls. Slope ranges from 1 to 5 percent.

Typical pedon of Denton silty clay, 1 to 3 percent slopes; 1.8 miles south on Farm Road 590 from Mercers Gap Baptist Church; 0.4 mile west on field land; 260 feet north on lane; 160 feet west of lane in a cultivated field:

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) moist; moderate very fine to fine granular structure; very hard, very firm; few fine roots; few fine fragments of limestone; calcareous; moderately alkaline; abrupt smooth boundary.

A11—6 to 12 inches; very dark grayish brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) moist; moderate medium blocky structure parting to strong very fine blocky and fine granular; very hard, very firm; few fine roots; few fine pores; few fine fragments of limestone; calcareous; moderately alkaline; gradual wavy boundary.

A12—12 to 24 inches; dark brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/2) moist; moderate medium blocky structure parting to strong very fine blocky and granular; very hard, very firm; few fine roots; few fine pores; common fine fragments and concretions of limestone; calcareous; moderately alkaline; gradual wavy boundary.

B2ca—24 to 30 inches; brown (7.5YR 5/4) silty clay, brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, firm; common medium concretions of calcium carbonate and fragments of limestone as much as 25 mm in diameter; vertical streaks of dark soil material from horizons above extend to a depth of 30 inches; calcareous; moderately alkaline; gradual wavy boundary.

Cca—30 to 36 inches; very pale brown (10YR 8/3) marly clay loam, light yellowish brown (10YR 6/4) moist; massive; common soft bodies of calcium carbonate; calcareous; moderately alkaline; abrupt wavy boundary.

R—36 to 38 inches; hard white fractured limestone.

Solum thickness ranges from 22 to 40 inches over limestone bedrock, limestone bedrock interbedded with marly clays, shell limestones, or nodular limestones. Limestone fragments smaller than 3 inches in diameter make up from 1 to 10 percent of the soil mass. The A and B2 horizons have textures of silty clay or clay; silicate clay content ranges from 35 to 55 percent.

The A horizon is dark brown, brown, dark grayish brown, or very dark grayish brown. The mollic epipedon ranges from 16 to 30 inches in thickness.

Some pedons do not have a B horizon, but where present, the B2 horizon is brown, light brown, yellowish brown, or light olive brown.

Energy series

The Energy series consists of deep, loamy soils on bottom lands. These soils formed in loamy, calcareous alluvial sediments of mixed origin. Slope ranges from 0 to 1 percent.

Typical pedon of Energy fine sandy loam, in an area of Energy soils, frequently flooded; 5 miles north on Texas Highway 16 from the Comanche County Courthouse to intersection with Farm Road 2861; 0.1 mile east on Farm Road 2861; 0.55 mile north on paved road; 210 feet east in pasture:

A1—0 to 8 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; massive; hard, friable; common fine roots; calcareous; moderately alkaline; abrupt smooth boundary.

C1—8 to 28 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; massive; hard, firm; few fine roots; thin strata of fine sandy loam with evident bedding planes; calcareous; moderately alkaline; abrupt smooth boundary.

C2—28 to 38 inches; brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; massive; hard, firm; few fine roots; strata from 1/4 to 1 inch thick of fine sandy loam and clay loam with evident bedding planes; calcareous; moderately alkaline; abrupt smooth boundary.

C3—38 to 44 inches; very pale brown (10YR 7/3) loamy sand, brown (10YR 5/3) moist; single grained; slightly hard, friable; calcareous; moderately alkaline; abrupt smooth boundary.

C4—44 to 62 inches; brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; massive; hard, firm; stratification and bedding planes very distinct; calcareous; moderately alkaline.

The 10- to 40-inch control section is stratified fine sandy loam, sandy clay loam, silty clay loam, or clay loam and has thin strata of loamy sand. Clay content of the control section is 18 to 35 percent, and content of material coarser than very fine sand is more than 15 percent. Stratification varies from scarcely evident to pronounced.

The A horizon is light yellowish brown, pale brown, light brownish gray, grayish brown, or dark grayish brown. In places, thin layers below a depth of 10 inches are darker than allowed in the range of the surface layer. Where the A horizon has mollic colors, it is less than 10 inches thick. The A horizon is dominantly fine sandy loam, but ranges from sandy clay loam to loam.

The C horizon is brown, pale brown, very pale brown, light brownish gray, or grayish brown. Thin strata of very dark grayish brown or dark brown material are also in the control section.

Frio series

The Frio series consists of deep, loamy soils on bottom lands. These soils formed in calcareous silty clay loam and silty clay alluvium. Slope ranges from 0 to 1 percent.

Typical pedon of Frio clay loam, occasionally flooded; 0.65 mile south on Texas Highway 16 from the southeast corner of the Comanche County Square; 0.7 mile east and 0.7 mile south on a county road; 1.3 miles east on county road; 100 feet south in a cultivated field:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; moderate very fine and fine subangular blocky structure and moderate fine medium granular structure; hard, firm; common fine roots; calcareous; moderately alkaline; abrupt smooth boundary.

A11—6 to 18 inches; very dark grayish brown (10YR 3/2) silty clay; very dark brown (10YR 2/2) moist; strong very fine subangular blocky structure and strong very fine granular structure; very hard, firm; common fine roots; common fine pores; many worm casts; calcareous; moderately alkaline; gradual wavy boundary.

A12—18 to 36 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; very hard, firm; common fine roots; common fine pores; few worm casts; few threads and films of calcium carbonate in the lower part; few dark streaks and stains that are one unit of value darker than the matrix color; calcareous; moderately alkaline; gradual wavy boundary.

A13—36 to 50 inches; grayish brown (10YR 5/2) silty clay, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; very hard, firm; few fine roots; few fine pores; common threads and films of calcium carbonate in the upper part and many threads and films of calcium carbonate in the lower 6 inches; calcareous; moderately alkaline; clear wavy boundary.

C—50 to 62 inches; very pale brown (10YR 8/3) clay loam, pale brown (10YR 6/3) moist; massive; hard, firm; few soft bodies of calcium carbonate and few fine yellow calcareous concretions.

Depth to gravel, sand, or limestone ranges from 6 to 30 feet. Organic matter content decreases irregularly with depth; it is more than 0.5 percent at a depth of 50 inches.

The A11 and A12 horizons are brown, dark brown, grayish brown, dark grayish brown, or very dark grayish brown silty clay, silty clay loam, or clay loam, and clay content is 35 to 50 percent. The calcium carbonate equivalent of the 10- to 40-inch control section ranges from 10 to 40 percent. Structure is strong or moderate, subangular blocky and strong or moderate, granular. Between depths of 30 and 50 inches, some pedons have strata of more loamy or more clayey sediments.

Hassee series

The Hassee series consists of deep, loamy soils on uplands. These soils formed in clayey sediments. Slope ranges from 0 to 3 percent.

Typical pedon of Hassee loam, 1 to 3 percent slopes; about 8 miles north on Farm Road 2247 from its intersection with city street on the north side of Comanche, to its junction with county road at Soda Springs Community; 2.3 miles east on county road to farmhouse and field entrance gate; 0.3 mile south in a cultivated field:

A—0 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure when moist, massive and hard when dry; friable; few fine roots; slightly acid; clear smooth boundary.

A2g—8 to 12 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable; few fine roots; slightly acid; abrupt smooth boundary.

B21tg—12 to 20 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate coarse blocky structure; extremely hard, extremely firm; many continuous clay films on faces of peds; slightly acid; gradual smooth boundary.

B22tg—20 to 34 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium blocky structure; extremely hard, extremely firm; continuous clay films on faces of peds; slightly acid; gradual smooth boundary.

B3g—34 to 42 inches; gray (10YR 6/1) clay, dark gray (10YR 4/1) moist; few fine faint mottles of reddish yellow; weak medium blocky structure; very hard, very firm; neutral; gradual smooth boundary.

C—42 to 60 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; massive; hard, friable; common threads of calcium carbonate and few concretions of calcium carbonate; calcareous; moderately alkaline.

Solum thickness is 40 to 72 inches. Soft bodies or concretions of calcium carbonate are at depths of 28 to 50 inches.

The A horizon is slightly acid or neutral. The A1 or Ap horizon is very dark grayish brown, dark grayish brown, or grayish brown. The A2g horizon is light gray, gray, grayish brown, or light brownish gray.

The B2tg horizon is dark gray, very dark gray, very dark grayish brown, or dark grayish brown. Some pedons have few to common fine, reddish or yellowish mottles. The B2tg horizon ranges in clay content from about 45 to 60 percent. It is slightly acid through moderately alkaline. The B3g and Cca horizons are light gray, gray, light brownish gray, grayish brown, dark grayish brown, very dark grayish brown, brown, dark brown, pale brown, or yellowish brown. Reaction is neutral through moderately alkaline, and the horizon is calcareous. Some pedons contain a few pebbles of quartz.

Heaton series

The Heaton series consists of deep, sandy soils on uplands. These soils formed in thick, reddish, loamy materials. Slope ranges from 0 to 5 percent, but averages about 2 percent.

Typical pedon of Heaton loamy fine sand, 0 to 5 percent slopes, 2 miles north on an unnumbered paved highway from its intersection with Texas Highway 36 in Gustine; 0.2 mile west on private lane; 0.1 mile south; 750 feet west in a cultivated field:

Ap—0 to 8 inches; yellowish brown (10YR 5/4) loamy fine sand, dark yellowish brown (10YR 4/4) moist; single grained; slightly hard, friable; few fine roots; neutral; clear smooth boundary.

A2—8 to 34 inches; brown (7.5YR 5/4) loamy fine sand, brown (7.5YR 4/4) moist; single grained; slightly hard, friable; few fine roots; slightly acid; clear smooth boundary.

B21t—34 to 50 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; moderate medium subangular blocky structure; very hard, firm; common medium roots; common fine and medium pores; patchy clay films on faces of peds; slightly acid; gradual smooth boundary.

B22t—50 to 68 inches; red (2.5YR 4/6) sandy clay loam, red (2.5YR 4/6) moist; moderate medium subangular blocky structure; very hard, firm; few fine roots; few fine pores; patchy clay films on faces of peds; slightly acid; gradual smooth boundary.

B23t—68 to 80 inches; reddish yellow (5YR 6/8) fine sandy loam, yellowish red (5YR 5/8) moist; weak fine subangular blocky structure; hard, friable; few fine roots; few fine pores; few clay films and clay bridging on sand grains; slightly acid.

The solum ranges from 60 inches to more than 100 inches in thickness and from neutral to medium acid. Some pedons contain a few pebbles of quartz ironstone.

The A horizon is yellowish brown, yellowish red, brown, strong brown, light brown, pink, very pale brown, pale brown, dark yellowish brown, grayish brown, or light brownish gray. Some pedons do not have an A2 horizon.

The Bt horizon is yellowish red, red, reddish brown, or reddish yellow. The upper 20 inches of the Bt horizon is sandy clay loam; the average clay content ranges from 20 to 35 percent. Some pedons have mottles in the B22t or B23t horizon; where present, mottles are strong brown, brownish yellow, yellowish brown, light olive brown, light yellowish brown, olive yellow, or light olive gray. The B23t horizon is sandy clay loam or fine sandy loam.

Hensley series

The Hensley series consists of shallow, loamy soils on uplands. These soils formed in loamy and clayey materials over thick beds of hard limestone.

Typical pedon of Hensley stony loam, 0 to 3 percent slopes; 0.3 mile west on Farm Road 587 from its intersection with Farm Road 1477 at Sipe Springs; 0.1 mile north on county road; 2.0 miles northwest at fork of county road; 150 feet north of road:

A—0 to 5 inches; reddish brown (5YR 5/4) stony loam, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; hard, firm; common fine roots; common fine pores; flat fragments of limestone, 6 to 30 inches in diameter, cover 2 to 40 percent of the surface; neutral; clear smooth boundary.

B2t—5 to 18 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate medium blocky structure; very hard, very firm; few fine roots; few fine pores; many distinct clay films on faces of peds; neutral; abrupt smooth boundary.

R—18 to 19 inches; hard limestone.

Solum thickness to the lithic contact ranges from 10 to 20 inches.

Fragments of limestone and ironstone and gravel-sized, ferruginous pebbles make up from 0 percent to about 5 percent, by volume, of the A horizon. Fragments of limestone from gravel to stone size cover from 0 percent to about 40 percent of the surface. The A horizon is dark reddish gray, reddish brown, or brown loam or stony loam. The A horizon is slightly acid through mildly alkaline.

The Bt horizon is reddish brown, dark reddish brown, red, or dark red. The Bt horizon, exclusive of limestone or ferruginous pebbles, is clay loam or clay, and clay content ranges from 35 to 55 percent. The Bt horizon is neutral through moderately alkaline.

Karnes series

The Karnes series consists of deep, loamy soils on uplands. These soils formed in calcareous, loamy sediments. Slope ranges from 1 to 8 percent.

Typical pedon of Karnes loam, 1 to 5 percent slopes; 2.1 miles east on Farm Road 2561 from its junction with Farm Road 1476 in Newburg; 50 feet south of field fence in a cultivated field:

Ap—0 to 8 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak fine subangular blocky and granular structure; slightly hard, friable; many fine roots; common fine concretions of calcium carbonate on the surface and in the surface layer; calcareous; moderately alkaline; abrupt clear boundary.

B21—8 to 24 inches; very pale brown (10YR 7/4) sandy loam, light yellowish brown (10YR 6/4) moist; weak fine subangular blocky structure; hard, slightly firm; many fine roots; many fine pores; many worm casts; common fine concretions of calcium carbonate, but they decrease with depth; many films and threads of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B22—24 to 40 inches; very pale brown (10YR 8/4) sandy loam, very pale brown (10YR 7/4) moist; weak fine subangular blocky structure; hard, slightly firm; few fine roots; many tubes and pores; few worm casts; common fine concretions of calcium carbonate; many films and threads of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B3—40 to 48 inches; very pale brown (10YR 8/4) fine sandy loam, very pale brown (10YR 7/4) moist; weak fine subangular blocky structure; slightly hard, friable; few fine roots; few fine pores; many films and threads of calcium carbonate; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C1—48 to 56 inches; very pale brown (10YR 8/4) fine sandy loam, very pale brown (10YR 7/4) moist; massive; slightly hard, friable; many fine tubes and pores; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C2—56 to 62 inches; very pale brown (10YR 8/3) fine sandy loam, very pale brown (10YR 7/3) moist; massive; slightly hard, friable; few fine concretions of calcium carbonate; calcareous; moderately alkaline.

Solum thickness ranges from 34 inches to about 50 inches. The calcium carbonate equivalent of the 10- to 40-inch control section ranges from 40 to 80 percent or more.

The A and B horizons are brown, grayish brown, light brownish gray, pale brown, very pale brown, light brown, light yellowish brown, pinkish gray, pink, yellowish brown, or light gray. Total clay ranges from 18 to 30 percent. Content of silicate clay ranges from 10 to 18 percent. Small fragments and concretions of limestone make up from 0 to 15 percent, by volume, of the solum.

Krum series

The Krum series consists of deep, clayey soils on uplands. These soils formed in valley areas in thick beds of unconsolidated calcareous, clayey sediments. Slope ranges from 0 to 3 percent.

Typical pedon of Krum silty clay, 1 to 3 percent slopes; 13 miles southwest on Farm Road 590 from its intersection with Texas Highway 16 in Comanche to Mercers Gap; 800 feet northwest on county road; 250 feet southwest in a cultivated field:

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate fine subangular structure; hard, firm, sticky and plastic; common fine roots; calcareous; moderately alkaline; clear smooth boundary.

A1—10 to 36 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; hard, firm, sticky and plastic; common fine roots; common fine pores; calcareous; moderately alkaline; gradual smooth boundary.

B2—36 to 56 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate medium blocky structure; very hard, very firm, sticky and plastic; few fine roots; few fine pores; peds have shiny pressure faces; darker soil in vertical streaks from horizons above extend through this layer along partially sealed cracks; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Cca—56 to 62 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; massive; hard, firm, sticky and plastic; about 10 percent by volume weakly and strongly cemented concretions of calcium carbonate and a few soft bodies of calcium carbonate; calcareous; moderately alkaline.

Solum thickness is 38 to 70 inches. The soils when dry have cracks, 0.4 inch to 1.2 inches wide, that extend from the surface to a depth of about 24 to 58 inches. The 10- to 40-inch control section is silty clay or clay that contains 40 to 60 percent clay, 0 to 10 percent pebbles of limestone, and 5 to 25 percent calcium carbonate equivalent. Horizons having value and chroma of less than 3.5 (moist) are 14 to 36 inches thick.

The A horizon is very hard grayish brown, dark grayish brown, grayish brown, dark gray, brown, or dark brown.

The B horizon is brown, grayish brown, pale brown, yellowish brown, light yellowish brown, or light brown. Visible concretions and powdery bodies of calcium carbonate make up from less than 1 percent to about 10 percent, by volume, of the horizon.

The C horizon is pale brown, light yellowish brown, brownish yellow, light brown, reddish yellow, or light reddish brown. It is silty clay loam, silty clay, or clay. Segregations of calcium carbonate make up from 2 to 20 percent, by volume, of the horizon.

Lamkin series

The Lamkin series consists of deep, loamy soils on bottom lands. These soils formed in calcareous, stratified alluvial sediments on natural levees of larger streams. Slope ranges from 0 to 1 percent.

Typical pedon of Lamkin clay loam, occasionally flooded; 3.7 miles east on Texas Highway 36 from its intersection with unnumbered paved highway in Gustine to its intersection with Farm Road 1702; 1.3 miles north on Farm Road 1702; 100 feet west in a pecan grove:

A1—0 to 16 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; hard, firm; many fine roots; few films and threads of calcium carbonate in lower 8 inches; many worm casts and holes; calcareous; moderately alkaline; gradual smooth boundary.

C1—16 to 24 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; massive; hard, friable; many fine roots; many fine pores; common worm casts; common films and threads of calcium carbonate; calcium carbonate equivalent is 18 percent; calcareous; moderately alkaline; gradual smooth boundary.

C2—24 to 36 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; stratified with very pale brown (10YR 7/3) very fine sandy loam; many strata less than 1 inch thick; hard, friable; many fine roots; many fine pores; few worm casts; calcium carbonate equivalent is 18 percent; calcareous; moderately alkaline; gradual smooth boundary.

C3—36 to 42 inches; very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; massive; common thin lenses and strata of silty clay loam, silt loam, and loamy sand; hard, friable; few fine roots; few fine pores; calcareous; moderately alkaline; gradual smooth boundary.

C4—42 to 54 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; stratified with common thin lenses of very fine sandy loam; hard, friable; few fine roots; few fine pores; calcareous; moderately alkaline; gradual smooth boundary.

C5—54 to 62 inches; brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; massive; hard, friable; few fine roots; few fine pores; spots and thin lenses of pale brown (10YR 6/3) silt loam; calcareous; moderately alkaline.

Average texture of the control section is silt loam, loam, silty clay loam, or clay loam. Silicate clay makes up 18 to 30 percent of the 10- to 40-inch control section; calcium carbonate equivalent is 15 to 25 percent.

The A1 horizon is dark grayish brown, dark brown, grayish brown, very dark grayish brown, or dark brown. The mollic A horizon ranges from 10 to 20 inches in thickness. It ranges from clay loam to loam.

The C horizon is pale brown, very pale brown, brown, yellowish brown, dark grayish brown, dark brown, or grayish brown. Texture of individual strata in the C horizon varies from loamy very fine sand to silty clay.

Leeray series

The Leeray series consists of deep, clayey soils on uplands. These soils formed in calcareous clays. They have gilgai microrelief, and they crack when dry. Slope ranges from 0 to 3 percent.

Typical pedon of Leeray clay, 1 to 3 percent slopes; at the center of a microdepression; 8.3 miles west on Farm Road 587 from its intersection with Texas Highway 16 in De Leon to Duster; 2 miles west on Farm Road 587; 3.5 miles north and 1,200 feet west on county road; 60 feet north in a cultivated field:

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; very hard, very firm, sticky and plastic; common fine roots; calcareous; moderately alkaline; abrupt smooth boundary.

A11—5 to 32 inches; very dark grayish brown (10YR 3/2) clay, very dark brown (10YR 2/2) moist; moderate fine blocky structure; very hard, very firm, very sticky and plastic; few fine roots; prominent grooved slickensides; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

A12—32 to 54 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; distinct parallelepipeds with the long axis tilted 30 degrees from the horizontal parting to moderate fine blocky structure; extremely hard, extremely firm; few fine roots; prominent grooved slickensides that intersect; few strongly cemented concretions of calcium carbonate and a few soft powdery bodies of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

AC—54 to 65 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium blocky structure; prominent grooved slickensides that intersect; extremely hard, very firm; few soft powdery bodies of calcium carbonate; many films and threads of calcium carbonate; few fine black concretions; calcareous; moderately alkaline.

The solum ranges from 40 to 90 inches in thickness. When dry, these soils have cracks, as much as 3 inches wide, that extend from the surface to a depth of more than 20 inches. Intersecting slickensides are at a depth of about 16 to 24 inches. Clay content ranges from 40 to 60 percent throughout the 10- to 40-inch control section. Cycles of microknolls and microdepressions are repeated each 8 to 23 feet. In undisturbed areas, microknolls are 3 to 12 inches higher than the microdepressions. The extremes of amplitude, or waviness, of the boundary between the A and AC horizon range from about 15 inches at the center of the microknoll to 50 inches at the center of the microdepression.

The A horizon is grayish brown, dark grayish brown, very dark grayish brown, brown, dark brown, or very dark brown. The AC horizon is grayish brown, dark grayish brown, dark brown, pale brown, brown, dark yellowish brown, olive brown, or light olive brown. These horizons have few to many concretions or soft powdery forms of calcium carbonate. A few rounded pebbles of quartz or fragments of limestone are on the surface or in the A and AC horizons of some pedons. The Cca horizon, where present, is brown, light brown, pale brown, very pale brown, light brownish gray, reddish brown, light olive brown, light yellowish brown, dark yellowish brown, or yellowish brown.

Lewisville series

The Lewisville series consists of deep, loamy soils on uplands. These soils formed in calcareous alluvium along major streams. Slope ranges from 1 to 5 percent.

Typical pedon of Lewisville clay loam, 1 to 3 percent slopes; about 10 miles south on Texas Highway 16 from its intersection with U.S. Highway 377-67 in Comanche to its junction with Farm Road 1476; 0.1 mile south on Texas Highway 16; 2.9 miles west-southwest on winding county road to its junction with a north-south county road; 0.25 mile south on county road; 660 feet west in a cultivated field near a large pecan tree:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; moderate fine subangular blocky and granular structure; hard, firm; many fine roots; many worm casts; calcareous; moderately alkaline; clear smooth boundary.

A1—6 to 18 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; moderate to strong fine subangular blocky and granular structure; very hard, firm; many fine roots; many worm casts; calcareous; moderately alkaline; gradual smooth boundary.

B21ca—18 to 26 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; strong fine subangular blocky structure; very hard, firm; common fine roots; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22ca—26 to 46 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; strong fine subangular blocky and blocky structure; very hard, firm; common fine roots; common fine pores; common films, threads, and soft bodies of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B3ca—46 to 62 inches; light yellowish brown (10YR 6/4) clay loam, brown (10YR 5/3) moist; moderate fine subangular blocky structure; hard, firm; few fine roots; many films, threads, and soft bodies of calcium carbonate; calcareous; moderately alkaline.

Solum thickness is 30 inches to about 70 inches. Silicate clay content ranges from 24 to 35 percent.

The A1 horizon is dark brown, brown, very dark grayish brown, dark grayish brown, and grayish brown. Thickness of the A horizon ranges from 7 to 20 inches.

The B horizon ranges from clay loam to silty clay. The upper part of the B2ca horizon is brown, strong brown, dark grayish brown, dark yellowish brown, pinkish gray, light brownish gray, light brown, and light yellowish brown. Visible carbonates in the form of concretions, bodies, and threads make up from 3 to 8 percent, by volume, of the horizon. The lower part of the B2ca horizon ranges from about 1 unit of value or chroma higher than the upper part and contains about 5 to 15 percent visible carbonates. The calcium carbonate equivalent of this horizon ranges from 25 to about 40 percent. In some places the pedon is underlain by beds of gravel at a depth of 3 to 15 feet.

Luckenbach series

The Luckenbach series consists of deep, loamy soils on uplands. These soils formed in thick beds of calcareous, loamy and clayey sediments. Slope ranges from 1 to 3 percent.

Typical pedon of Luckenbach clay loam, 1 to 3 percent slopes, about 10 miles south on Texas Highway 16 from its intersection with U.S. Highway 377-67 in Comanche to its junction with Farm Road 1476 near Newburg; 0.05 mile south on Texas Highway 16; 0.2 mile west on county road; 0.3 mile south and 75 feet east in a cultivated field:

Ap—0 to 8 inches; dark brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; weak fine subangular blocky and fine granular structure; very hard, firm; few fine roots; mildly alkaline; abrupt smooth boundary.

B21t—8 to 14 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; strong fine and medium blocky structure; very hard, very firm; few fine roots; few fine pores; prominent clay films on faces of peds; mildly alkaline; gradual smooth boundary.

B22t—14 to 22 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; strong fine blocky structure; very hard, very firm; few fine roots; few fine pores; common distinct clay films on faces of peds; few dark streaks and stains along vertical faces; mildly alkaline; gradual smooth boundary.

B23tca—22 to 36 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; moderate fine subangular blocky structure; very hard, firm; few distinct clay films on faces of peds; common films and threads and a few soft bodies of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

Cca—36 to 50 inches; pink (7.5YR 7/4) clay loam, reddish yellow (7.5YR 6/6) moist; massive; very hard, firm; 40 percent by volume concretions of calcium carbonate and lime-coated pebbles; common soft bodies of calcium carbonate; calcareous; moderately alkaline; gradual boundary.

C—50 to 62 inches; very pale brown (10YR 8/4) clay loam, very pale brown (10YR 7/4) moist; massive; very hard, firm; 15 percent by volume lime-coated pebbles of limestone; calcareous; moderately alkaline.

Solum thickness ranges from 35 to 50 inches. Secondary carbonates in the form of concretions or soft bodies are at a depth of 18 to 28 inches. The mollic epipedon is 12 to 20 inches thick.

The A horizon is very dark grayish brown, dark grayish brown, dark brown, or dark reddish gray. It is slightly acid, neutral, or mildly alkaline. Coarse fragments range from none to a few pebbles of chert.

The Bt horizon is reddish brown or brown. The upper 4 to 6 inches of the B horizon is brown in some pedons. The Bt horizon is clay or clay loam, and clay content ranges from 35 to 55 percent. Reaction is mildly alkaline or moderately alkaline.

The C horizon is very pale brown, pale brown, pink, or light brown clay or clay loam. Rounded pebbles of limestone and fragments of chert make up from 5 to 20 percent of the horizon. Soft bodies and weakly to strongly cemented concretions of calcium carbonate and lime-coated pebbles make up from 5 to 15 percent, by volume, of the C horizon.

May series

The May series consists of deep, loamy soils on uplands. These soils formed in loamy alkaline alluvial sediments. Slope ranges from 0 to 3 percent.

Typical pedon of May fine sandy loam, 0 to 1 percent slopes; about 4 miles east on Texas Highway 36 from Rising Star, to the junction of Texas Highway 36 and Farm Road 587; 1 mile east on Texas Highway 36; 3.8 miles south on county road; 1 mile east on county road; 405 feet north on county road; 135 feet east in a cultivated field:

Ap—0 to 12 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; massive; hard, friable; slightly acid; clear smooth boundary.

B21t—12 to 28 inches; brown (10YR 4/3) sandy clay loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; very hard, firm; common fine roots; common fine pores; patchy clay films on faces of peds; neutral; gradual smooth boundary.

B22t—28 to 37 inches; brown (10YR 4/3) sandy clay loam, dark brown (10YR 3/3) moist; weak coarse subangular blocky structure; very hard, firm; common fine roots; common fine pores; patchy clay films on faces of peds; neutral; gradual smooth boundary.

B3—37 to 41 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; very hard, firm; few fine roots; few fine pores; few thin clay films on faces of peds; few films and threads of calcium carbonate and a few concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Cca—41 to 62 inches; very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; massive; hard, friable; common films and threads of calcium carbonate and a few concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 40 to 70 inches thick. Depth to films, threads, or soft bodies of calcium carbonate ranges from 36 to 62 inches.

The A horizon is brown, dark brown, grayish brown, dark grayish brown, dark yellowish brown, or yellowish brown. Some pedons have an Ap horizon of light brownish gray or pale brown.

The Bt horizon is brown, dark brown, dark grayish brown, yellowish brown, or light yellowish brown. Some pedons have faint reddish or yellowish mottles in the lower part. The B21t and B22t horizons are sandy clay loam or clay loam, and clay content ranges from 20 to 35 percent. Reaction is neutral to mildly alkaline. The B3 horizon is sandy clay loam, loam, or fine sandy loam. It is mildly alkaline or moderately alkaline and calcareous.

The Cca horizon is yellowish brown, light yellowish brown, very pale brown, light gray, or white. It is sandy clay loam, loam, or fine sandy loam.

Menard series

The Menard series consists of deep, loamy soils on uplands. These soils formed in loamy sediments. Slope ranges from 1 to 8 percent.

Typical pedon of Menard fine sandy loam, 3 to 5 percent slopes; 2.8 miles southeast on Texas Highway 16 from courthouse in Comanche; 7.1 miles south on winding county road; 1,971 feet west; in rangeland:

A—0 to 10 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak granular structure; hard, friable; many fine roots; neutral; clear smooth boundary.

B21t—10 to 18 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate medium blocky structure; very hard, firm; common fine roots; common fine pores; few thin clay films on faces of peds; ped exteriors have dark coatings; slightly acid; gradual wavy boundary.

B22t—18 to 30 inches; yellowish red (5YR 5/8) sandy clay loam, yellowish red (5YR 4/8) moist; weak medium blocky structure; hard, firm; few fine roots; common fine pores; common thin clay films on faces of peds; neutral; gradual wavy boundary.

B3ca—30 to 34 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; weak fine subangular blocky structure; hard, firm; few soft bodies of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Cca—34 to 60 inches; very pale brown (10YR 8/4) sandy clay loam, very pale brown (10YR 7/4) moist; massive; common soft bodies and concretions of calcium carbonate; thin strata of weakly cemented calcareous sandstone; calcareous; moderately alkaline.

The solum ranges from 30 to 50 inches in thickness.

The A horizon is brown, grayish brown, light brownish gray, light yellowish brown, or pale brown. It is neutral or mildly alkaline.

The B2t horizon is reddish brown, yellowish red, or red. It is sandy clay loam or clay loam and has clay content of about 25 to 35 percent. Reaction is slightly acid through mildly alkaline. Depth to the calcareous B3ca horizon ranges from 20 to 36 inches.

The C horizon is calcareous material that has texture of sandy loam, sandy clay loam, or clay loam. Fragments of limestone or concretions of calcium carbonate make up from 5 to 20 percent of the C horizon. Some pedons are underlain by thin strata of limestone or weakly cemented sandstone.

Nimrod series

The Nimrod series consists of deep, sandy soils on uplands. These soils formed in sandy and loamy sediments. Slope ranges from 0 to 5 percent.

Typical pedon of Nimrod fine sand, 0 to 5 percent slopes; 0.6 mile north on Farm Road 589 from U.S. Post Office in Sidney; 0.5 mile north on county road; 450 feet west in a cultivated field:

Ap—0 to 6 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grained; loose; few fine roots; medium acid; clear smooth boundary.

A2—6 to 26 inches; very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grained; loose; slightly acid; abrupt wavy boundary.

B21t—26 to 34 inches; brownish yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) moist; common medium distinct mottles of light brownish gray (10YR 6/2) and few fine prominent mottles of yellowish red (5YR 4/6); moderate medium blocky structure; very hard, very firm; few medium roots; few fine and medium pores; few clay films on faces of peds; medium acid; gradual wavy boundary.

B22t—34 to 52 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; common medium faint mottles of gray (10YR 6/1) and common coarse to medium distinct mottles of yellowish red (5YR 5/8) and brownish yellow (10YR 6/6); moderate medium blocky structure; very hard, very firm; few fine roots; few fine pores; few clay films on faces of peds; strongly acid; gradual wavy boundary.

B23t—52 to 72 inches; light gray (10YR 7/1) sandy clay loam, gray (10YR 6/1) moist; common coarse to medium distinct mottles of yellowish red (5YR 5/8) and brownish yellow (10YR 6/6); weak medium subangular blocky structure; very hard, firm; few fine roots; few fine pores; few patchy clay films on faces of peds; medium acid; gradual wavy boundary.

C—72 to 80 inches; light gray (10YR 7/1) sandy clay loam, gray (10YR 6/1) moist; common coarse distinct mottles of reddish yellow (7.5YR 6/6); massive; hard, firm; slightly acid.

The solum ranges from 60 to 80 inches in thickness.

The A horizon ranges from 20 to 40 inches in thickness. The A1 or Ap horizon is light brown, light gray, brown, grayish brown, dark grayish brown, yellowish brown, pale brown, or light yellowish brown. The A2 horizon is pale brown, very pale brown, or light yellowish brown.

The Bt horizon is light gray mottled in shades of brown, red, yellow, and gray in some pedons. In other pedons the matrix is yellowish brown or brownish yellow mottled with red and gray. The upper 20 inches of the Bt horizon is sandy clay loam; the average clay content ranges from 20 to 35 percent. The Bt horizon is strongly acid or medium acid.

The C horizon ranges from mottled, dominantly light gray sandy clay loam to little-altered, firm sands.

Owens series

The Owens series consists of shallow, clayey soils on uplands. These soils formed in beds of shaly clay or clayey shale. Slope ranges from 1 to 25 percent.

Typical pedon of Owens stony clay, 3 to 25 percent slopes; 0.27 mile southeast on Farm Road 1477 from its intersection with Farm Road 587 in Sipe Springs; 1.75 miles east on county road to gate entrance; 390 feet southwest in rangeland:

A1—0 to 6 inches; grayish brown (2.5Y 5/2) stony clay, dark grayish brown (2.5Y 4/2) moist; weak fine blocky structure; very hard, very firm; common fine roots; surface crusts upon drying; fragments of sandstone and limestone 1 to 4 feet in diameter cover about 10 percent of the surface; calcareous; moderately alkaline; gradual smooth boundary.

Bca—6 to 16 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium blocky structure; very hard, extremely firm; few fine roots; few fine pores; few soft bodies and concretions of calcium carbonate in lower part; calcareous; moderately alkaline; gradual smooth boundary.

C—16 to 30 inches; light olive brown (2.5Y 5/4) shaly clay, olive brown (2.5Y 4/4) moist; massive; extremely hard, extremely firm; few thin streaks of gray and red shale; calcareous; moderately alkaline.

The solum is 10 to 20 inches thick.

The A horizon is olive, pale olive, olive brown, light olive brown, light yellowish brown, brown, grayish brown, and light brownish gray. Fragments of limestone, sandstone, or ironstone are on the surface and in the upper part of the A horizon in some pedons.

The Bca horizon is olive, pale olive, olive brown, light olive brown, grayish brown, light brownish gray, pale brown, brown, yellowish brown, or light yellowish brown. Calcium carbonate in the Bca horizon ranges from barely visible films and threads to about 5 percent, by volume, soft powdery bodies.

The C horizon ranges from olive to weak red shaly clay, clayey shale, or in some pedons weakly consolidated shale.

Patilo series

The Patilo series consists of deep, sandy soils on uplands. These soils formed in thick, sandy beds that appear to have been reworked somewhat by wind. Slope ranges from 0 to 5 percent.

Typical pedon of Patilo fine sand in an area of Patilo-Nimrod complex, 0 to 5 percent slopes; 8.2 miles northwest from the Comanche County Courthouse on Texas Highway 36 to its intersection with Farm Road 588; 4 miles north on Farm Road 588 to Beattie store; 0.9 mile south of Beattie store on Farm Road 588; 0.15 mile west on lane; 50 feet south in rangeland:

A1—0 to 4 inches; brown (10YR 5/3) fine sand, dark brown (10YR 3/3) moist; weak granular structure to single grained; loose; few fine roots; neutral; clear smooth boundary.

A2—4 to 44 inches; white (10YR 8/2) fine sand, light gray (10YR 7/2) moist; single grained; loose; few fine roots; slightly acid; abrupt wavy boundary.

B21t—44 to 50 inches; mottled light gray (10YR 7/2), yellow (10YR 7/6), and red (2.5YR 5/8) sandy clay loam; moderate medium subangular blocky structure; hard, slightly firm; common fine roots; common fine pores; few thin clay films on faces of peds; medium acid; gradual smooth boundary.

B22t—50 to 60 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; common medium and coarse distinct yellow (10YR 7/6) mottles; weak medium subangular blocky structure; hard, firm; few fine roots; few fine pores; few thin clay films on faces of peds; strongly acid; clear smooth boundary.

B23t—60 to 70 inches; light gray (5Y 7/2) sandy clay loam, light olive gray (5Y 6/2) moist; common coarse distinct brownish yellow (10YR 6/8) and yellowish red (5YR 5/6) mottles; medium fine blocky structure; very hard, very firm; few fine roots; few fine pores; few thin clay films on faces of peds; strongly acid.

Solum thickness ranges from 65 inches to more than 100 inches.

The A horizon is fine sand. Reaction ranges from neutral through medium acid. The A1 horizon is dark grayish brown, dark brown, grayish brown, brown, light brownish gray, pale brown, very pale brown, light yellowish brown, or yellowish brown. The A2 horizon is brown, very pale brown, light gray, white, light yellowish brown, or reddish yellow. The boundary between the A2 and B2t horizons is wavy to irregular.

The Bt horizon is dominantly sandy clay loam. Clay content is dominantly 25 to 35 percent, but ranges from 18 to 35 percent. Reaction ranges from slightly acid through strongly acid. Base saturation ranges from 40 to 75 percent throughout the argillic horizon. The Bt horizon is light gray, very pale brown, pale brown, light yellowish brown, brownish yellow, reddish yellow, yellowish red, or yellow and has mottles of red, yellow, and gray in varying sizes and amounts.

Pedernales series

The Pedernales series consists of deep, sandy and loamy soils on uplands. These soils formed in alkaline loamy earths. Slope ranges from 1 to 8 percent.

Typical pedon of Pedernales fine sandy loam in an area of Pedernales soils, 1 to 5 percent slopes, eroded; 3.7 miles east on Texas Highway 36 from its intersection with an unnumbered highway in Gustine; 6.6 miles northeast on Farm Road 1702 to its intersection with Farm Road 2823; 0.8 mile northwest on Farm Road 1702; 0.2 mile west on county road; 21 feet south in pasture:

Ap—0 to 4 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; hard, friable; few fine roots; neutral; abrupt smooth boundary.

B21t—4 to 14 inches; red (2.5YR 4/6) sandy clay, dark red (2.5YR 3/6) moist; moderate medium blocky structure; very hard, very firm; few fine roots; few fine pores; common distinct clay films on faces of peds; neutral; gradual smooth boundary.

B22t—14 to 28 inches; yellowish red (5YR 5/6) sandy clay, yellowish red (5YR 4/6) moist; moderate medium blocky structure; very hard, very firm; few fine roots; few fine pores; common distinct clay films on faces of peds; neutral; gradual smooth boundary.

B23t—28 to 42 inches; yellowish red (5YR 5/6) sandy clay, yellowish red (5YR 4/6) moist; weak coarse blocky structure; very hard, very firm; few fine roots; few fine pores; few thin clay films on faces of peds; neutral; gradual smooth boundary.

Cca—42 to 60 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; massive; hard, friable; common soft bodies of white calcium carbonate and small concretions of calcium carbonate; calcareous; moderately alkaline.

Solum thickness ranges from 35 to 60 inches. Secondary carbonates are at a depth of 28 to 50 inches.

The A horizon is fine sandy loam or loamy fine sand. It is reddish brown, yellowish red, brown, light brown, pale brown, or light yellowish brown. The A horizon is slightly acid through mildly alkaline.

The Bt horizon is red, reddish brown, yellowish red, or reddish yellow. Some pedons have yellowish or brownish mottles in the lower part of the Bt horizon. Clay content ranges from 35 to 55 percent.

The Cca horizon is sandy clay loam or sandy clay that, in some places, contains thin strata of soft limestone. The Cca horizon is pinkish gray, light red, light reddish brown, pink, light brown, reddish brown, or reddish yellow. Concretions and soft powdery bodies of calcium carbonate make up from 5 to 30 percent, by volume, of the C horizon, and the percentage does not decrease with depth.

Purves series

The Purves series consists of shallow, clayey soils on uplands. These soils formed in interbedded limestones and calcareous, clayey marls. Slope ranges from 1 to 40 percent.

Typical pedon of Purves stony clay in an area of Purves-Bolar association, undulating; 3.7 miles east on Texas Highway 36 from Gustine; 6.6 miles northeast on Farm Road 1702 to its intersection with Farm Road 2823; 1 mile east on Farm Road 2823 to its intersection with county road; 300 feet north on county road; 60 feet west in rangeland:

A11—0 to 6 inches; dark grayish brown (10YR 4/2) stony clay, very dark grayish brown (10YR 3/2) moist; strong fine subangular blocky and granular structure; very hard, firm; many medium roots; calcareous; moderately alkaline; gradual smooth boundary.

A12ca—6 to 18 inches; dark grayish brown (10YR 4/2) gravelly clay, very dark grayish brown (10YR 3/2) moist; strong fine subangular blocky and granular structure; very hard, firm; common fine roots; common worm casts; common concretions and soft bodies of calcium carbonate; calcareous; moderately alkaline; abrupt smooth boundary.

R—18 to 19 inches; indurated limestone.

Solum thickness ranges from 8 to 20 inches. Limestone fragments 2 to 250 mm across the long axis make up from 0 to 35 percent, by volume, of the material above the bedrock. Secondary carbonates are concretions, soft bodies, coatings, and pendants on fragments of limestone.

The A horizon is very dark gray, dark gray, very dark grayish brown, dark grayish brown, dark brown, or brown. The texture of the fine earth is clay or stony clay, and clay content ranges from 40 to 55 percent.

Sunev series

The Sunev series consists of deep, loamy soils on uplands. These soils formed in loamy alluvial sediments that are high in content of calcium carbonate. Slope ranges from 3 to 8 percent.

Typical pedon of Sunev clay loam, 3 to 5 percent slopes; 5.8 miles west on Farm Road 1689 from its intersection with Texas Highway 36 on the west side of Comanche; 0.5 mile south on county road; 30 feet south in rangeland:

A11—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine blocky and subangular blocky structure; hard, friable; common fine roots; common worm casts; few fine concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

A12—6 to 16 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; hard, friable; common fine roots; common worm casts and holes; calcium carbonate equivalent is about 30 percent; few fine concretions of calcium carbonate; calcareous; moderately alkaline, gradual smooth boundary.

B2ca—16 to 28 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; strong medium granular and weak fine subangular blocky structure; hard, friable; few fine roots; common worm casts and holes; many films and threads of calcium carbonate; many fine concretions of calcium carbonate; calcium carbonate equivalent is about 48 percent; calcareous; moderately alkaline; gradual smooth boundary.

B3ca—28 to 44 inches; reddish yellow (7.5YR 6/6) clay loam, strong brown (7.5YR 5/6) moist; strong fine granular and moderate fine subangular blocky structure; hard, friable; few fine roots; few fine pores; few worm casts and holes; many films and threads of calcium carbonate; calcium carbonate equivalent is about 53 percent; calcareous; moderately alkaline; gradual smooth boundary.

Cca—44 to 60 inches; very pale brown (10YR 7/3) fine sandy loam, pale brown (10YR 6/3) moist; massive; hard, friable; common concretions and soft bodies of calcium carbonate; few thin strata of weakly cemented sandstone; calcium carbonate equivalent is about 30 percent; moderately alkaline; calcareous.

Solum thickness is 40 to 70 inches. Calcium carbonate equivalent in the control section is 40 to 70 percent. Content of silicate clay is 18 to 30 percent, and content of carbonate clay is 2 to 10 percent. The volume of quartz and limestone pebbles ranges from 0 to 15 percent.

The A horizon is dark grayish brown, very dark grayish brown, dark brown, grayish brown, or brown.

The Bca horizon is brown, pale brown, very pale brown, yellowish brown, reddish yellow, or light yellowish brown.

The C horizon is very pale brown or reddish yellow fine sandy loam, loam, clay loam, or silty clay loam. Films and threads of calcium carbonate are evident in all horizons, and they increase in amount with depth.

Tarrant series

The Tarrant series consists of shallow, clayey soils on uplands. These soils formed in clayey marl and in residuum weathered mainly from limestone. Slope ranges from 1 to 20 percent.

Typical pedon of Tarrant cobbly clay in an area of Tarrant association, undulating; about 8 miles southwest on Farm Road 590 from its intersection with Texas Highway 16 in the south part of Comanche to Mercers Gap; 0.3 mile east on county road; and 144 feet northeast in rangeland:

A11—0 to 4 inches; very dark grayish brown (10YR 3/2) cobbly clay, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; hard, firm; common fine roots; 20 percent gravel- and cobble-sized fragments of limestone and fragments of chert on the surface and in the horizon; calcareous; moderately alkaline; gradual smooth boundary.

A12ca—4 to 16 inches; very dark grayish brown (10YR 3/2) cobbly clay, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; hard, firm; common fine roots; 60 percent gravel- and cobble-size fragments of chalky limestone; the larger fragments have secondary deposits that are 1/2 to 1 inch thick and that have pendants on the lower side; calcareous; moderately alkaline; abrupt wavy boundary.

R—16 to 17 inches; hard limestone. This layer is coarsely fractured and has dark soil in the fractures.

Thickness of the solum ranges from 6 to 20 inches and corresponds with the depth to indurated limestone. Coarse fragments make up from 35 to 65 percent of the solum; the percentage ranges from 10 to 60 percent in the A11 horizon and from 60 to 90 percent in the A12 horizon. Coarse fragments greater than 3 inches in diameter make up from 25 to 65 percent of the soil. The limestone fragments in the upper 4 inches of some pedons do not have secondary coating of calcium carbonate, but the coating is 1 cm or more thick on some fragments immediately above the R layer. Carbonates are in the form of coatings and pendants.

The A horizon is dark brown, dark grayish brown, very dark grayish brown, or very dark brown. The A horizon is cobbly clay, and clay content ranges from 45 to 60 percent.

Thurber series

The Thurber series consists of deep, loamy soils on uplands. These soils formed in alkaline, clayey sediments. Slope ranges from 0 to 3 percent.

Typical pedon of Thurber clay loam, 1 to 3 percent slopes; 0.1 mile north of Sipe Springs to junction of Farm Roads 587 and 1477; 0.3 mile west on Farm Road 587 to county road; 1.7 miles north on county road; 180 feet east in rangeland:

A1—0 to 8 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; massive; very hard, firm; few fine roots; neutral; abrupt smooth boundary.

B21t—8 to 26 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate coarse blocky structure; extremely hard, extremely firm; few fine roots; many prominent clay films on faces of peds; neutral; gradual smooth boundary.

B22t—26 to 36 inches; brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; moderate medium blocky structure; extremely hard, extremely firm; many distinct clay films on faces of peds; few fine soft bodies and concretions of calcium carbonate; moderately alkaline; gradual smooth boundary.

B3ca—36 to 50 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; weak coarse blocky structure; extremely hard, extremely firm; many medium concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C—50 to 64 inches; yellowish brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; massive; very hard, very firm; few films and threads of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 30 to 60 inches in thickness. Depth to films, threads, or soft bodies of calcium carbonate ranges from 15 to 28 inches.

The A horizon is brown, dark brown, dark grayish brown, grayish brown, or very dark grayish brown. The A horizon is both massive and very hard when dry. Reaction is slightly acid through mildly alkaline.

The Bt horizon is very dark grayish brown, dark grayish brown, grayish brown, brown, dark brown, yellowish brown, dark yellowish brown, olive brown, or light olive brown. Clay content ranges from 35 to 55 percent. Reaction ranges from neutral through mildly alkaline in the B21t horizon and is mildly alkaline or moderately alkaline in the B22t horizon.

The C horizon ranges from brownish, calcareous clay to olive gray shaly clay.

Truce series

The Truce series consists of deep, loamy soils on uplands. These soils formed in materials weathered from shales interbedded with strata of sandstone. Slope ranges from 1 to 20 percent.

Typical pedon of Truce fine sandy loam, 1 to 3 percent slopes; about 9 miles west on Farm Road 587 from its intersection with Texas Highway 16 in De Leon to its intersection with Farm Road 679 at Duster; 2 miles west of Duster on Farm Road 587; 3 miles north on county road to Oakland Cemetery; 0.7 mile west; and 50 feet south in rangeland:

A1—0 to 3 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; very hard, friable; few fine roots; slightly acid; abrupt smooth boundary.

A2—3 to 5 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; very hard, friable; few fine roots; slightly acid; abrupt smooth boundary.

B21t—5 to 12 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; moderate medium blocky structure; extremely hard, very firm; few fine roots; few fine pores; common clay films on faces of peds; neutral; gradual smooth boundary.

B22t—12 to 30 inches; brown (7.5YR 5/4) clay, brown (7.5YR 4/4) moist; moderate medium blocky structure; extremely hard, very firm; few fine roots; few fine pores; common clay films on faces of peds; neutral; gradual smooth boundary.

B3—30 to 48 inches; yellowish brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; weak medium blocky structure; extremely hard, very firm; few fine roots; few fine pores; few patchy clay films; calcareous; moderately alkaline; gradual smooth boundary.

C—48 to 60 inches; olive yellow (2.5Y 6/6) shaly clay, light olive brown (2.5Y 5/6) moist; massive; interbedded with light brown (7.5YR 6/4) brittle shale; few concretions of calcium carbonate; calcareous; moderately alkaline.

Solum thickness ranges from 40 to 60 inches. Sandstone fragments make up from 0 to 25 percent, by volume, of the A horizon, and range in size from 2 mm to about 18 inches in diameter.

The A horizon is fine sandy loam or stony fine sandy loam. It is medium acid through neutral. The A1 horizon is brown, pale brown, yellowish brown, or dark grayish brown. The A2 horizon is 1 or 2 units of value lighter in color than the A1 horizon.

The Bt horizon has clay content of 35 percent to about 50 percent. The B21t horizon is reddish brown, dark reddish brown, or yellowish red. Reaction is slightly acid through mildly alkaline. The B22t horizon is brown, strong brown, yellowish brown, reddish yellow, or reddish brown. Reaction is neutral through moderately alkaline. The B3 horizon ranges from yellowish brown or olive yellow through light olive brown. In some pedons, the B3 horizon has faint reddish or olive mottles; in others it is free of mottles. Reaction is mildly alkaline through moderately alkaline and calcareous.

The C horizon is clayey shale, partially weathered shale, or brittle shaly clay. It is pale olive, olive, gray, light gray, light olive brown, yellowish brown, olive yellow, or light brown. It is mildly alkaline or moderately alkaline and calcareous.

Venus series

The Venus series consists of deep, loamy soils on stream terraces on uplands. These soils formed in thick beds of unconsolidated, calcareous, loamy sediments. Slope ranges from 1 to 3 percent.

Typical pedon of Venus loam, 1 to 3 percent slopes; about 10 miles southeast on Texas Highway 16 from its intersection with Farm Road 590 on the south edge of Comanche to its junction with Farm Road 1476; 0.2 mile east on Farm Road 1476; 75 feet north in a cultivated field:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak subangular blocky and weak granular structure; slightly hard, friable; many fine roots; many worm casts; few fine fragments of limestone; calcareous; moderately alkaline; clear smooth boundary.

A1—6 to 12 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak subangular blocky and weak granular structure; slightly hard, friable; many fine roots; many worm casts; few fine pebbles of limestone; calcareous; moderately alkaline; clear smooth boundary.

B21ca—12 to 20 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; weak subangular blocky structure; hard, slightly firm; many fine roots; common threads and films of calcium carbonate; few fine pebbles of limestone; few worm casts; calcareous; moderately alkaline; gradual smooth boundary.

B22ca—20 to 30 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak subangular blocky structure; hard, slightly firm; few fine roots; many films and threads of calcium carbonate, few fine pebbles of limestone; calcareous; moderately alkaline; gradual smooth boundary.

B23ca—30 to 44 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; weak subangular blocky structure; hard, slightly firm; many films and threads and a few soft bodies of calcium carbonate; common round pebbles of limestone; calcareous; moderately alkaline; clear smooth boundary.

Cca—44 to 62 inches; light yellowish brown (10YR 6/4) gravelly loam, yellowish brown (10YR 5/4) moist; massive, porous; hard, slightly firm; many films and threads of calcium carbonate; pebbles of limestone make up from 30 to 40 percent by volume; calcareous; moderately alkaline.

The solum is 40 to 70 inches thick.

The A horizon is brown, dark brown, grayish brown, dark grayish brown, or very dark grayish brown.

The B2ca horizon is brown, grayish brown, light brownish gray, pale brown, very pale brown, yellowish brown, and light yellowish brown loam, sandy clay loam, or clay loam. It is 18 to about 30 percent noncarbonate clay, and more than 15 percent is coarser than very fine sand. Concretions, films, threads, or soft bodies of calcium carbonate make up from 5 percent to about 20 percent, by volume, of the horizon. Calcium carbonate equivalent in the B2ca horizon is 15 to 40 percent.

The C horizon is fine sandy loam, loam, sandy clay loam, or clay loam. Some pedons are underlain by layers of gravel at a depth of about 3.5 to 8 feet.

Classification

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to the latest literature available (*6*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 15, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustalf (*Ust*, meaning burnt, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Haplustalfs (*Hapl*, meaning simple horizons, plus *Ustalf*, the suborder of Alfisols that has a dry moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Haplustalfs.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine, montmorillonitic, thermic, Typic Haplustalfs.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Formation of the soils

In this section, the factors of soil formation are discussed and related to the formation of soils in the survey area, and the processes of soil formation are explained.

Factors of soil formation

Soil is the product of the interaction of the five major factors of soil formation. These factors are climate, plant and animal life, parent material, relief, and time. The kind of soil that develops at any point on the earth is determined by these interacting factors.

Climate and plant and animal life are the active forces in soil formation. These forces act on the parent material, which has accumulated through the weathering of rock and unconsolidated deposits, and slowly change the material into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief, or topography. The parent material itself affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed to change the parent material into a soil pedon. The amount of time can be long or short, but generally a long time is required for distinct horizons to develop in a soil.

The interrelationship among the five factors of soil formation is complex, and the effect of any one factor is difficult to isolate. Each factor is discussed separately in the paragraphs that follow, but it is the interaction of all these factors, rather than their simple sum, that determines the nature of the soil.

Climate

Comanche County has a warm-temperate, subhumid climate with hot summers. This climate contributes to the formation of soils in several ways. Expansion at high temperatures and contraction at low temperatures fracture parent rock and soil material and hasten weathering. Patterns of rainfall distribution cause the soils to be alternately wet and dry. When a clay soil, such as Leeray clay, dries, it becomes severely cracked. The cracks fill with water during rains. After it becomes wet, the clay soil swells enough to close the cracks. This alternate shrinking and swelling causes the soil to churn and prevents the formation of clay accumulations. Other soils, such as Pedernales and Demona soils, have clayey lower layers. Water moving through the soil carries clay particles downward from the surface layer and deposits them as the movement of water slows. As clay accumulates, the water moves even slower and deposition of clay accelerates. Thus, the process tends to speed up and the lower layers eventually become clayey. Wind also affects the formation of soils in the county. The soil material that eventually developed into Patilo and Nimrod soils was reworked by wind.

Plant and animal life

Plants, man, animals, insects, bacteria, worms, and fungi are important in the formation of soils. Gains in organic matter and nitrogen in the soil, gains or losses in plant nutrients, and changes in structure and porosity are among the changes caused by living organisms. Tall prairie grasses had more influence on soil development than other plants in areas of the Purves-Bolar and Krum-Lewisville-Abilene map units. These tall grasses provided litter that protected the surface and added organic matter to the dark soils. The grass roots reached deep into the soil and fed on minerals at lower depths. Lime, minerals, and organic matter were distributed throughout the soil profile as these plants died and decomposed. The decomposed plant roots left channels that increased the intake of water and the aeration of the soil. Earthworms and other soil organisms fed on the decomposed roots. The borings of earthworms also helped channel water and air through the soil.

The vegetation, dominantly oak-savannah, has affected soils formed in areas of the Chaney-Demona and Truce-Thurber map units. The soils formed under hardwood vegetation are medium to low in organic matter content and have a light colored surface layer. Some of these soils are Chaney, Demona, Nimrod, Truce, Thurber, and Bonti soils.

Man has also influenced soil formation. He permitted cattle to graze the vegetation on the land. He plowed the land and planted crops. These activities have had their influence on soil formation.

Parent material

Parent material is the unconsolidated mass from which a soil is formed. It determines the limits of the chemical and mineral composition of the soil. The soils of Comanche County have developed from parent materials of three geologic ages, the Pennsylvanian, the Cretaceous, and the Quaternary periods (*4*).

Pennsylvanian age materials in the county are mainly interbedded sandstones and shales of the Strawn and Canyon Groups (*3*). These materials are in the northwestern part of the county. The sandstones are mostly acid, while the shales are alkaline. Acid soils, such as Bonti soils, are on ridges where the sandstone is near the surface. Truce soils developed where shale is more than 40 inches below the surface; they are neutral to acid in the upper part and alkaline in the lower part. Owens soils are shallow, calcareous, and clayey and are on more sloping hillsides where the shale is near the surface.

Cretaceous age materials are mainly interbedded limestones, marls, and sands. These materials are in the southern three-fourths of the county. The limestones and marls are interbedded and are mainly from the Walnut and Glen Rose Formations. Purves, Bolar, Tarrant, and Brackett soils are gently sloping to steep and are on benched hills and ridges where the limestone is near the surface. Krum and Denton soils are in lower areas underlain by interbedded clayey marl. These soils are more limy and have less distinct horizons than Chaney and Nimrod soils. The sands are mainly of the Paluxy and Twin Mountain Formations. Some of the sandier soils in the county formed from these two separate formations. Nimrod and Patilo soils formed mainly in the Paluxy Sand. Chaney and Demona soils formed in the Twin Mountain Formation. These soils are more acid and have more distinct soil horizons than the soils formed in limestone and marl.

The parent material of the soils on flood plains is recent deposits of alluvium. Many of these deposits on lower lying flood plains have been reworked from time to time, and new sediments have been deposited. Frio, Bosque, and Delcon soils are alkaline soils formed in deposits from the calcareous prairie areas. Soils formed from a mixture of loamy and sandy sediments are Energy and Lamkin soils.

Relief

Relief, or topography, affects soil formation through its influence on drainage, erosion, plant cover, and soil temperature.

The relief in Comanche County ranges from nearly level along streams and valleys to steep along escarpments. Owens soils formed mainly on south-facing slopes, and Truce soils formed on north-facing slopes in similar materials. Soil temperature is higher, plant cover is thinner, and erosion is greater on the south-facing slopes. Truce soils are deep and have well defined soil horizons; Owens soils are shallow and have less distinct horizons than Truce soils.

Karnes and Sunev soils also formed in similar parent materials. Generally, Karnes soils are steeper and more eroded than Sunev soils; erosion has kept their surface layer thin and light colored. Sunev soils, by contrast, have a dark surface layer. In some of the steeper limestone areas, shallow soils, such as Brackett and Purves soils, have formed because geologic erosion has removed soil material faster than soil horizons have formed.

Time

Time, usually a long time, is required for formation of soils that have distinct horizons. The differences in length of time that parent materials have been in place, therefore, are commonly reflected in the degree of development of the soil.

The soils in Comanche County range from young to old. The young soils have very little horizon development, and the older soils have well expressed soil horizons.

Energy soils are examples of young soils that show little development. The soil horizons of Energy soils still show the evidence of stratification, and very little change has occurred from the original, stream-deposited alluvium. Nimrod soils are examples of older soils that have well developed soil horizons. The parent materials of Nimrod soils have been in place for a long time. Clay particles have moved downward and have accumulated. The upper part of the surface layer is thin and dark; and the lower part of the surface layer is thick and leached.

References

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol. illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) Sellards, E. H., W. S. Adkins, and F. B. Plummer. 1932. Geology of Texas, stratigraphy, vol. 1. Univ. Texas Bull. 3232, 1007 pp., illus.

(4) Texas University Bureau of Economic Geology. 1972. Geologic atlas of Texas, Abilene sheet.

(5) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173-188 issued May 1962]

(6) United States Department of Agriculture. 1975. Soil taxonomy: a basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv. U.S. Dep. Agric. Handb. 436, 754 pp., illus.

Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Medium	6 to 9
High	More than 9

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Complex, soil. A map unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Compressible. Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Droughty. Soil holds too little water for plants during dry periods.

Erodes easily. Water erodes soil easily.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime. Excess carbonates. Excessive carbonates, or lime, restrict the growth of some plants.

Fast intake. The rapid movement of water into the soil.

Favorable. Favorable soil features for the specified use.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Forage. Plant material used as feed by domestic animals. Forage can be grazed or cut for hay.

Gilgai. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants are those that follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. Inadequate strength for supporting loads.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3.

Not needed. Practice not applicable.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the bases of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differencees are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water forms subsurface tunnels or pipelike cavities in the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Poor outlets. Surface or subsurface drainage outlets difficult or expensive to install.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range (or rangeland). Land that, for the most part, produces native plants suitable for grazing by livestock; includes land supporting some forest trees.

Range condition. The health or productivity of forage plants on a given range, in terms of the potential productivity under normal climate and the best practical management. Condition classes generally recognized are—*excellent, good, fair,* and *poor.* The classification is based on the percentage of original, or assumed climax vegetation on a site, as compared to what has been observed to grow on it when well managed.

Range site. An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind and amount of native vegetation.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake. The slow movement of water into the soil.

Slow refill. The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil blowing. Soil easily moved and deposited by wind.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Too clayey. Soil slippery and sticky when wet and slow to dry.

Too sandy. Soil soft and loose; droughty and low in fertility.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Unstable fill. Risk of caving or sloughing in banks of fill material.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent.—A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian.—A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched.—A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Wetness. Soil wet during period of use.

Illustrations

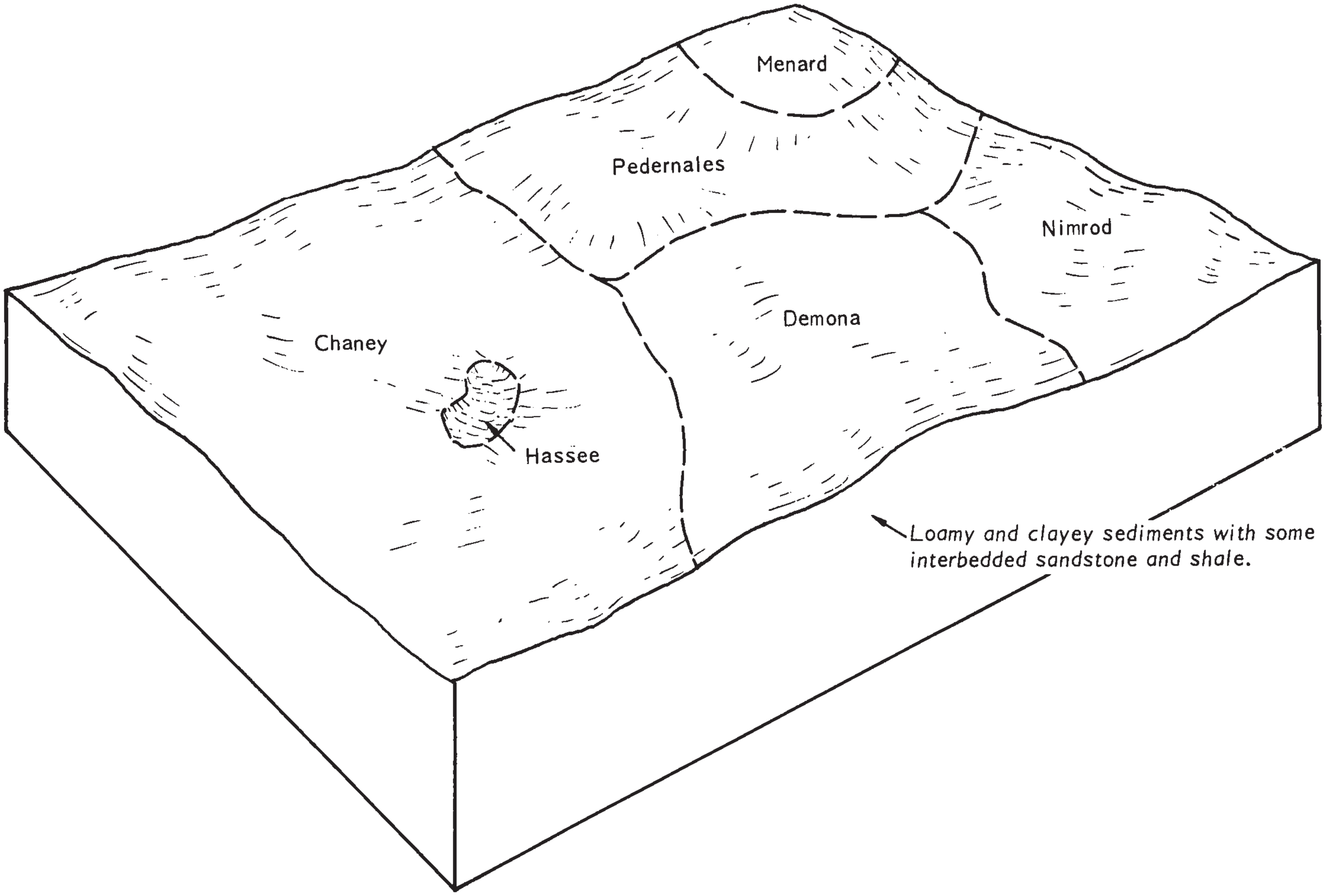

Menard
Pedernales
Nimrod
Demona
Chaney
Hassee
Loamy and clayey sediments with some interbedded sandstone and shale.

Figure 1.—Pattern of soils in the Chaney-Demona unit on the General Soil Map.

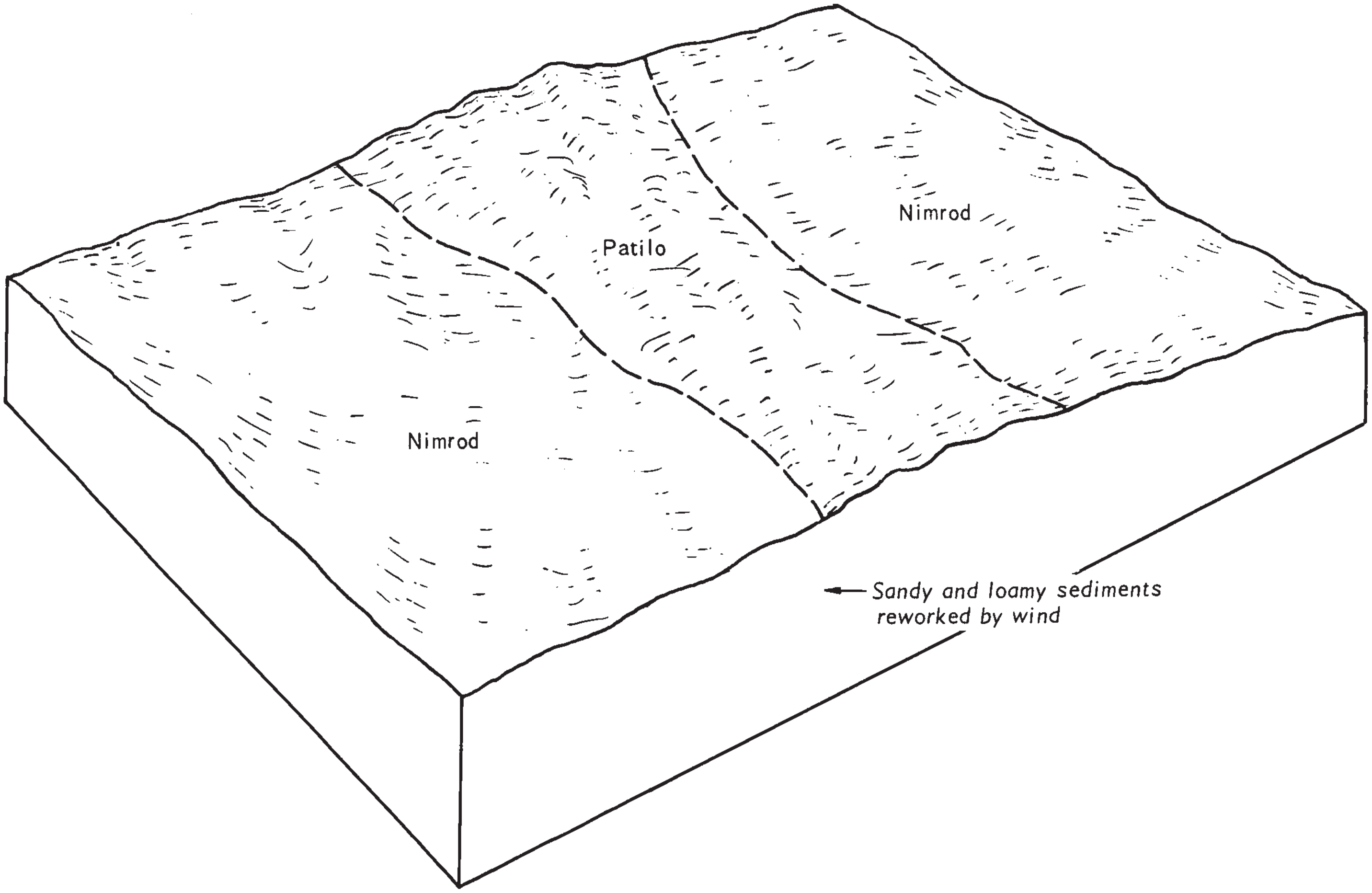


Figure 2.—Pattern of soils in the Nimrod-Patilo unit on the General Soil Map.

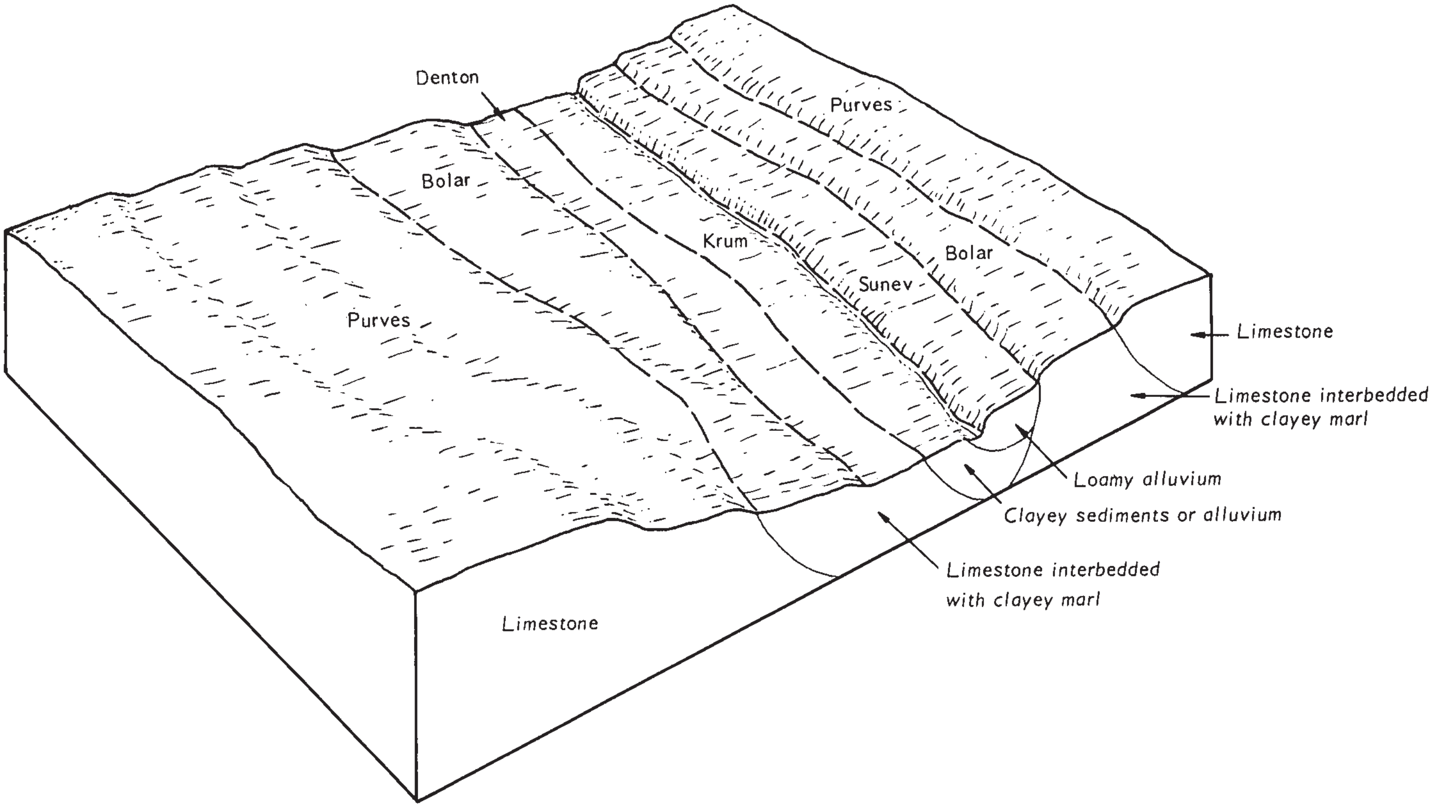

Denton
Purves
Bolar
Krum
Bolar
Sunev
Purves
Limestone
Limestone interbedded with clayey marl
Loamy alluvium
Clayey sediments or alluvium
Limestone interbedded with clayey marl
Limestone

Figure 3.—Pattern of soils in the Purves-Bolar unit on the General Soil Map.

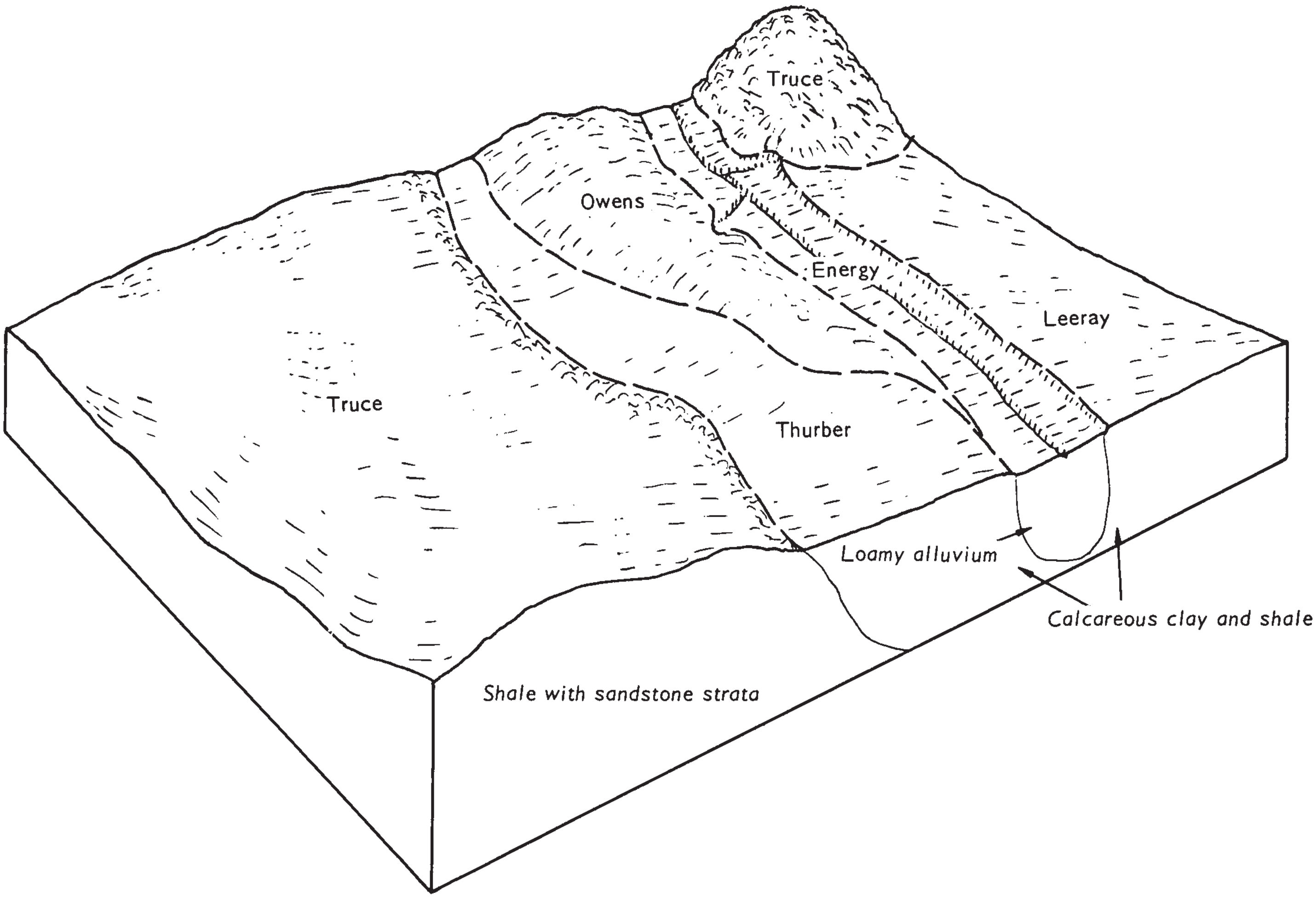


Figure 4.—Pattern of soils in the Truce-Thurber unit on the General Soil Map.

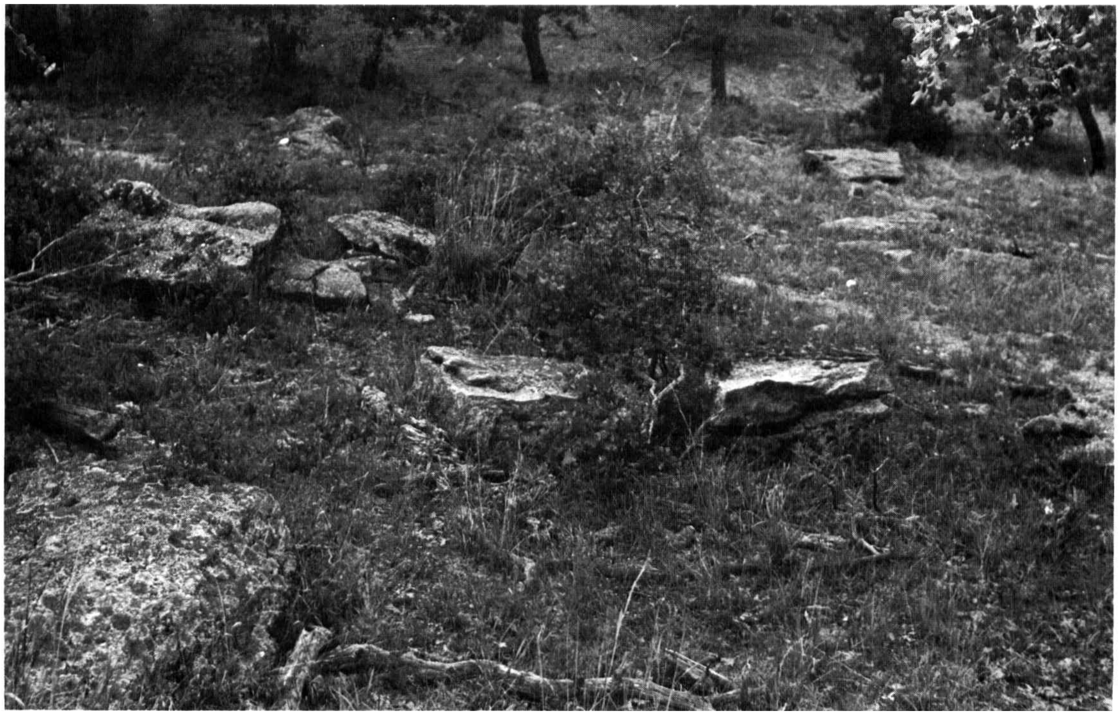


Figure 5.—Conglomerate sandstone in an area of Chaney stony loamy sand, 1 to 8 percent slopes.

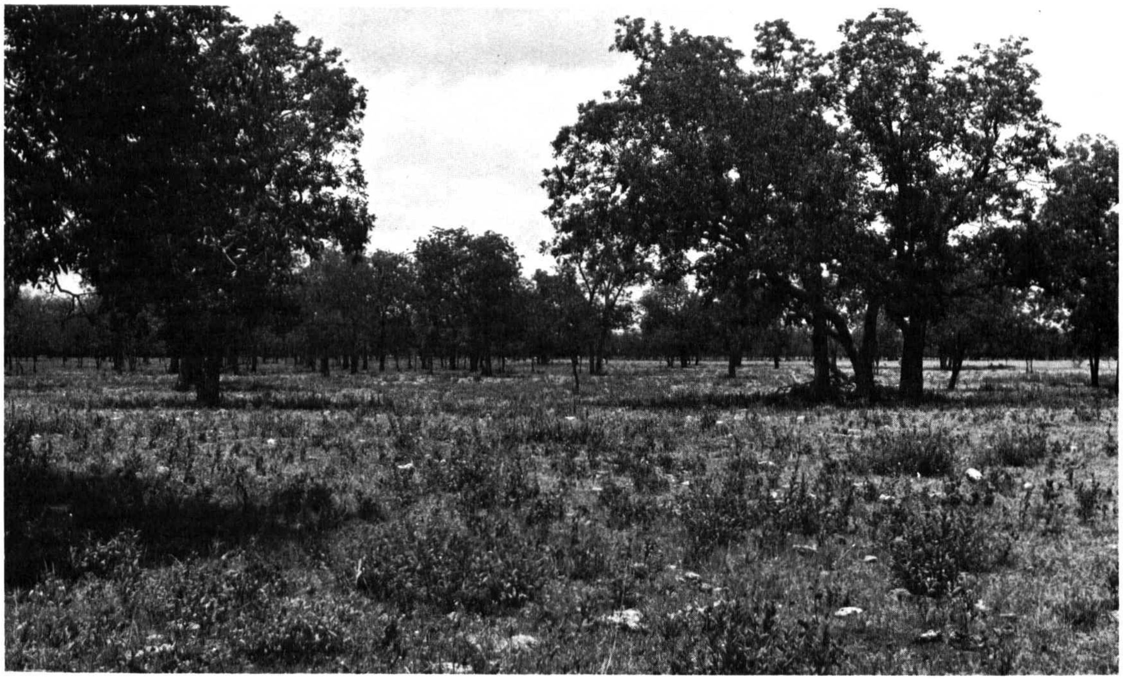


Figure 6.—Deleon clay, occasionally flooded, in an area of Clayey Bottomland range site.

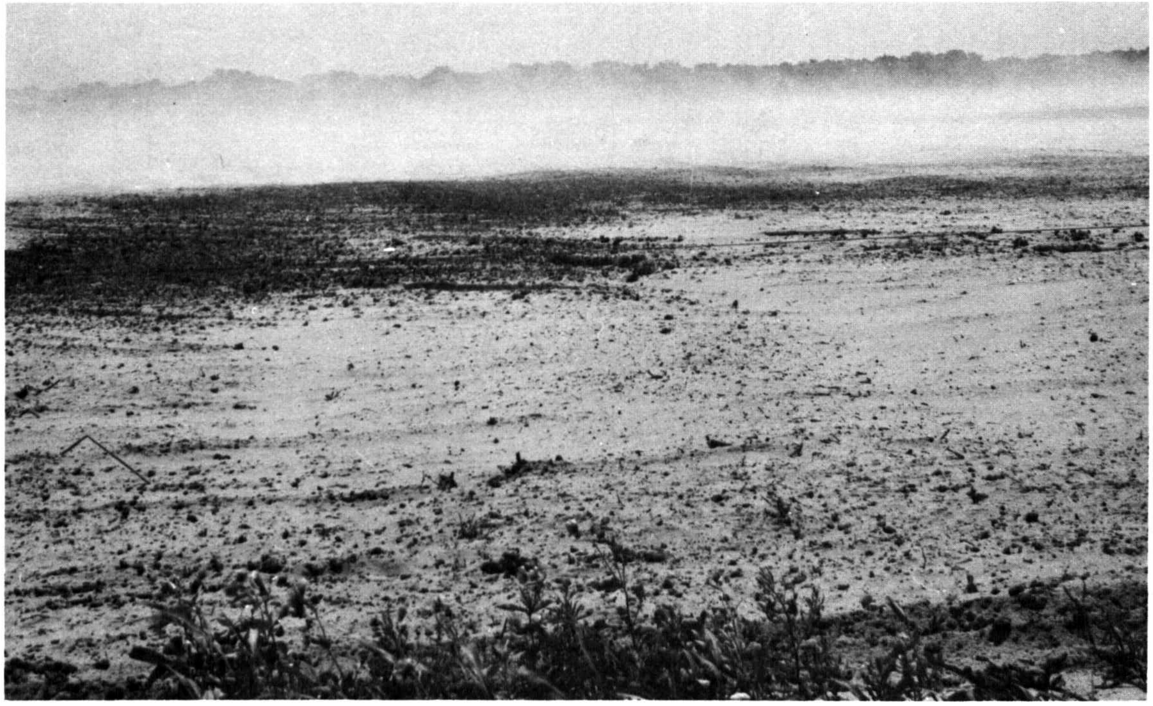


Figure 7.—Soil blowing on Demona loamy sand, 0 to 5 percent slopes.

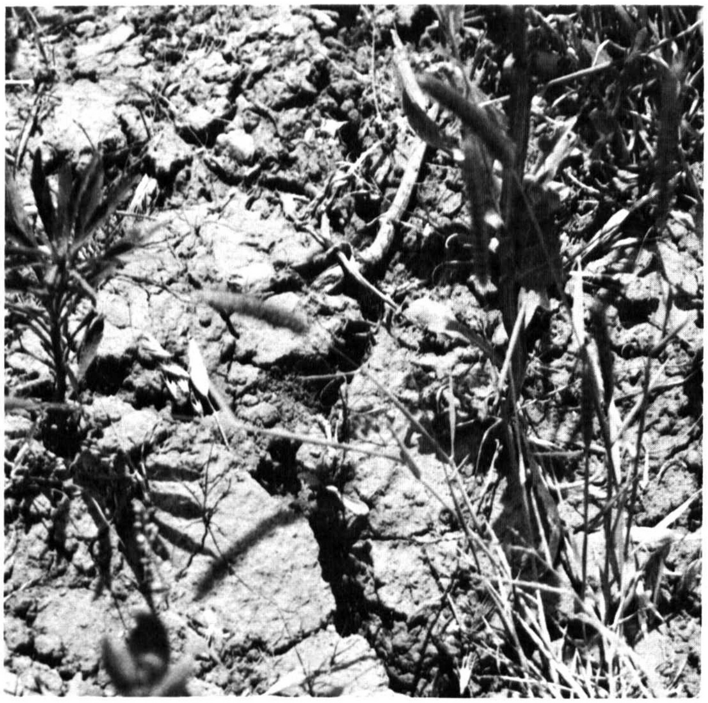


Figure 8.—Deep cracks at the surface of Leeray clay, 0 to 1 percent slopes.

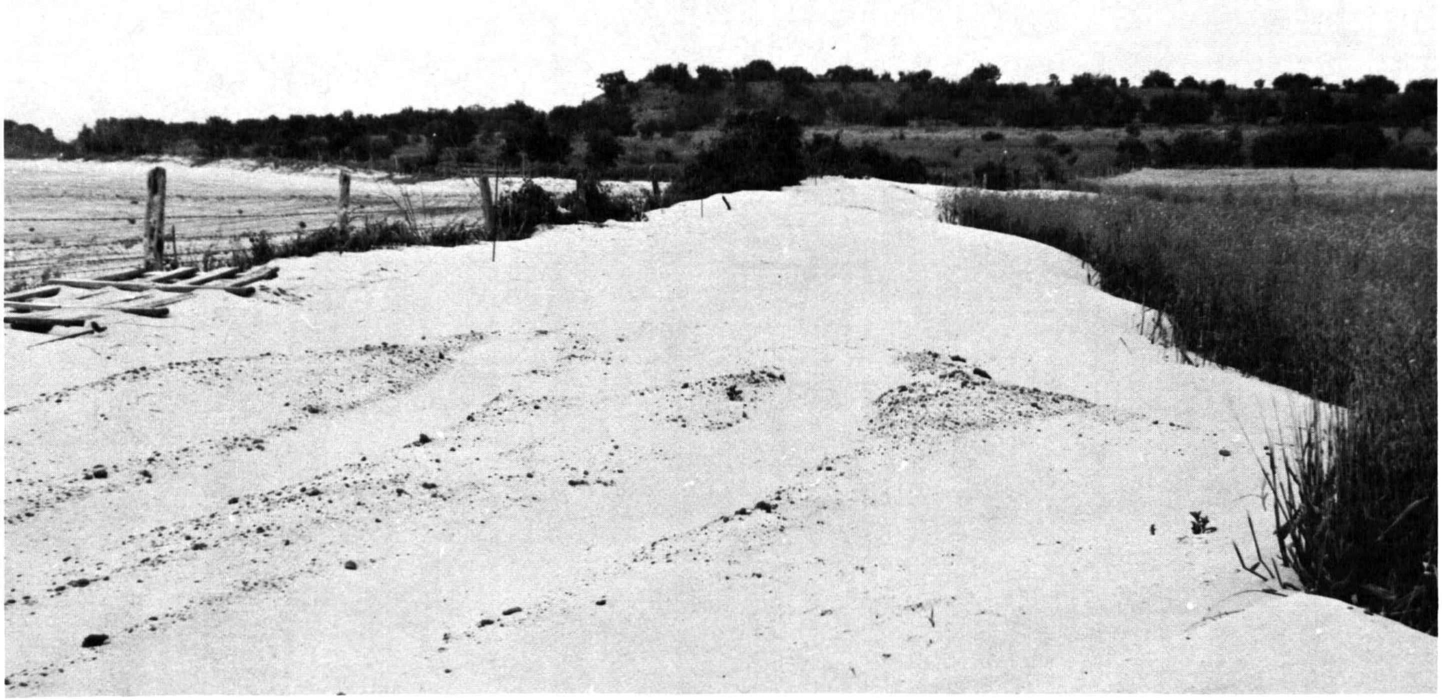


Figure 9.—Soil blown from the unprotected field on Nimrod fine sand, 0 to 5 percent slopes, at the left.

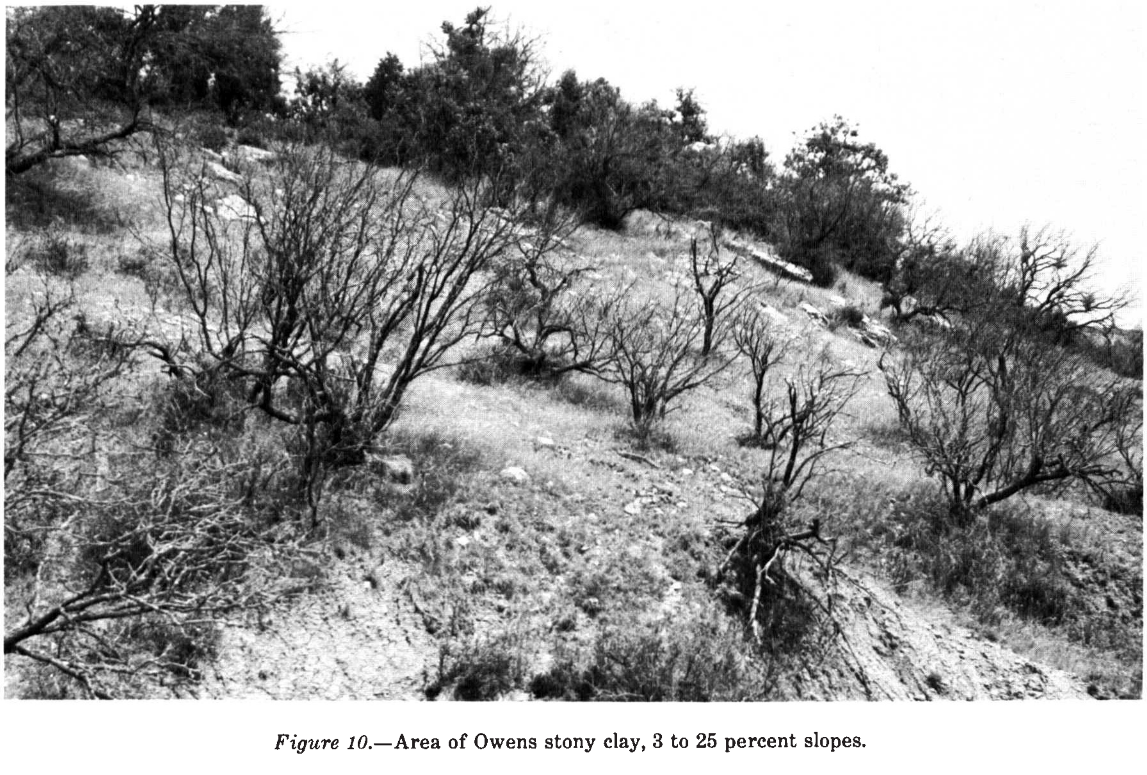


Figure 10.—Area of Owens stony clay, 3 to 25 percent slopes.

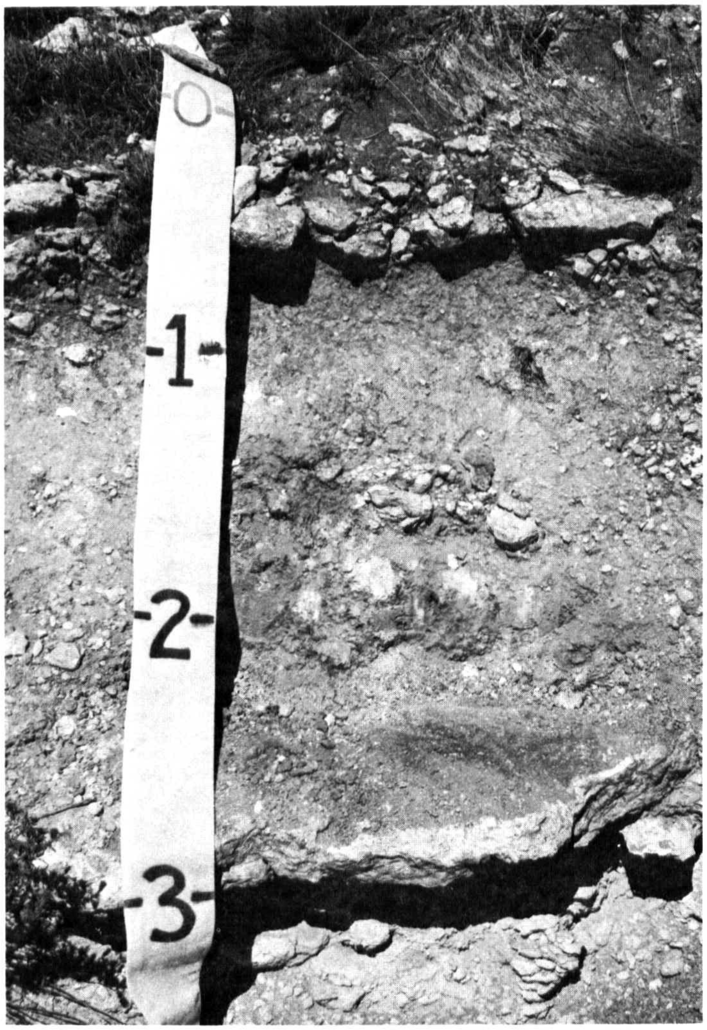


Figure 11.—Profile of Bolar stony clay loam in an area of Purves-Bolar association, undulating.

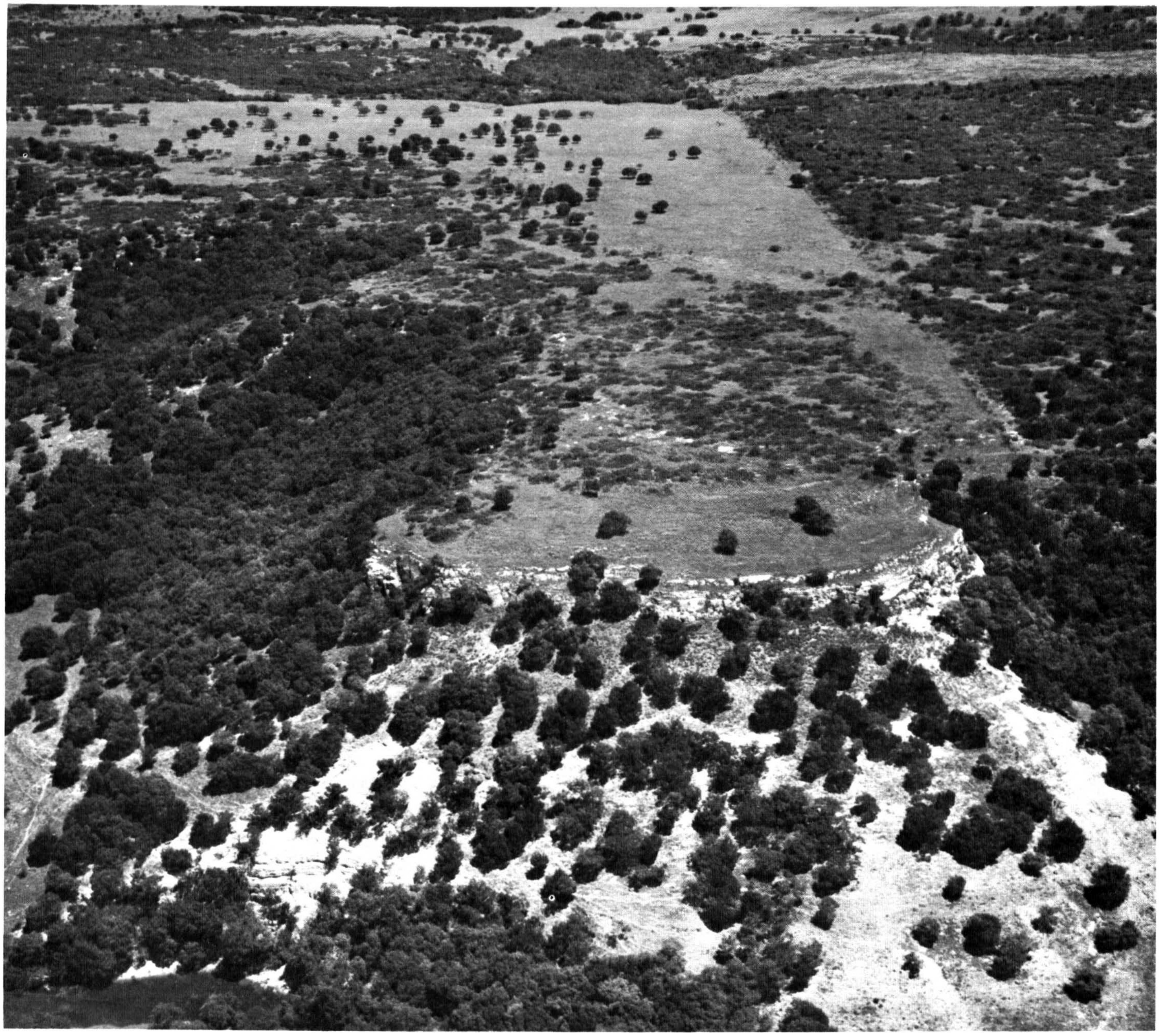


Figure 12.—Area of Tarrant association, undulating, on a broad mesa.

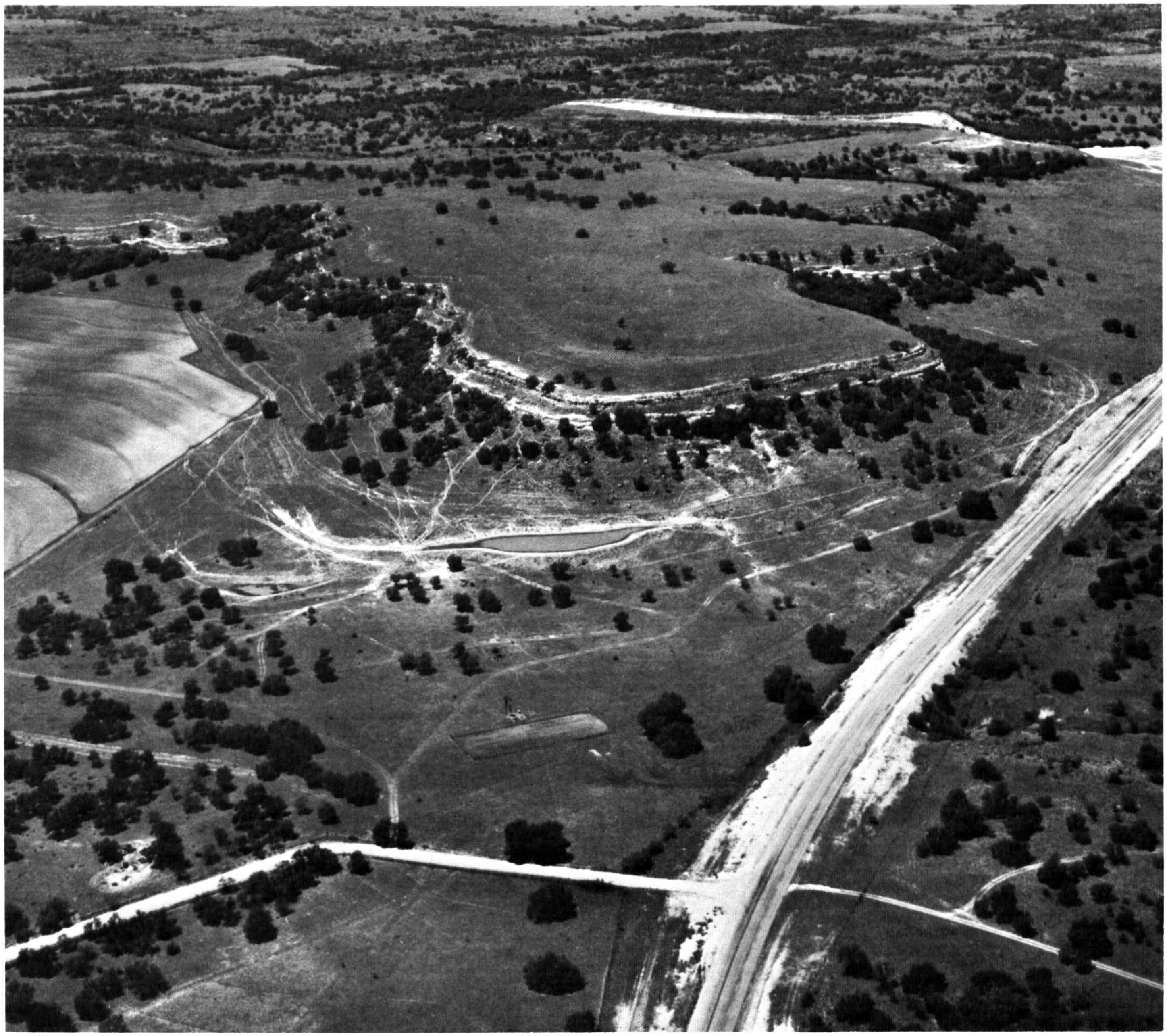


Figure 13.—Area of Tarrant-Rock outcrop association, hilly.

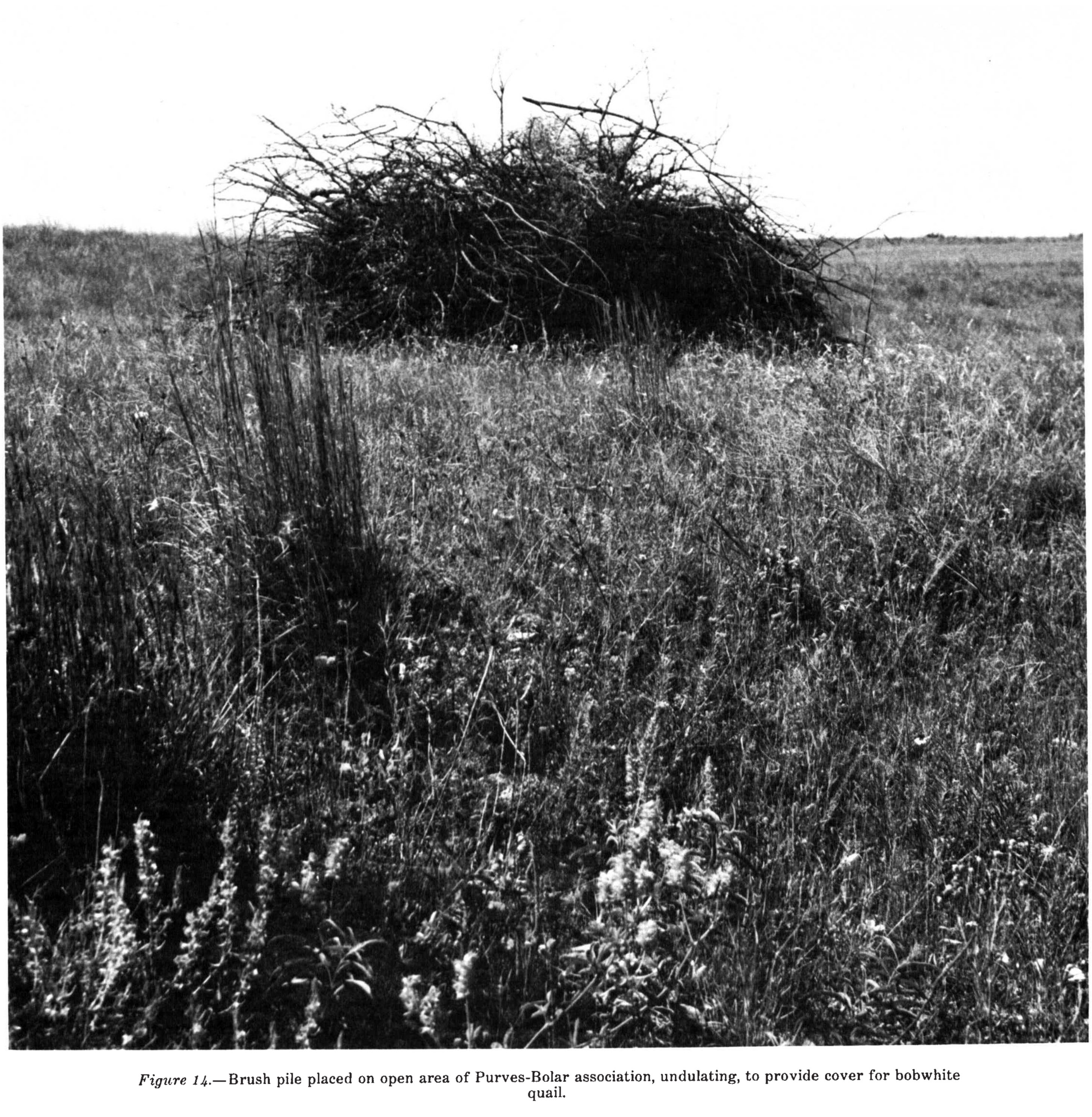


Figure 14.—Brush pile placed on open area of Purves-Bolar association, undulating, to provide cover for bobwhite quail.

Tables

TABLE 1.—POTENTIALS AND LIMITATIONS OF SOIL UNITS FOR SPECIFIED USES

Map unit	Extent of area	Cultivated farm crops	Pasture	Range	Urban uses
1. Chaney-Demona	43	High: soil blowing.	High	Medium: droughty.	Medium: too sandy.
2. Nimrod-Patilo	6	Medium: soil blowing, droughty.	Medium: droughty.	Medium: droughty.	Medium: too sandy.
3. Pedernales-Menard	5	Medium: droughty.	Medium: droughty.	Medium: droughty.	High: shrink-swell.
4. Purves-Bolar	23	Low: stones, shallow soil depth.	Low: stones, shallow soil depth.	Medium: shallow soil depth.	Medium: stones, shallow, depth to rock.
5. Tarrant	7	Low: stones, shallow soil depth.	Low: stones, shallow soil depth.	Low: shallow soil depth.	Low: stones, shallow depth to rock.
6. Denton-Purves	4	Medium: moderately deep to shallow soil depth.	Medium: moderately deep to shallow soil depth.	High	Medium: moderately deep to shallow soil depth.
7. Hensley	1	Low: stones, shallow soil depth.	Low: stones, shallow soil depth.	Medium: shallow soil depth.	Medium: shallow soil depth.
8. Krum-Lewisville-Abilene	8	High	High	High	Medium: shrink-swell, low strength.
9. Truce-Thurber	3	Medium: droughty.	Low: droughty.	Medium: droughty:	Medium: shrink-swell low strength.

TABLE 2.—ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AbA	Abilene loam, 0 to 1 percent slopes	3,210	0.5
AbB	Abilene loam, 1 to 3 percent slopes	6,560	1.1
BaC	Bastrop loamy fine sand, 1 to 5 percent slopes	4,400	0.7
BbA	Bastrop fine sandy loam, 0 to 1 percent slopes	460	0.1
BbB	Bastrop fine sandy loam, 1 to 3 percent slopes	1,100	0.2
BcB	Bolar clay loam, 1 to 3 percent slopes	3,950	0.6
BcC	Bolar clay loam, 3 to 5 percent slopes	19,340	3.1
BcD	Bolar clay loam, 5 to 8 percent slopes	2,350	0.4
BnB	Bonti fine sandy loam, 1 to 3 percent slopes	1,280	0.2
Bo	Bosque loam, occasionally flooded	9,050	1.5
BrC	Brackett-Bolar complex, 1 to 5 percent slopes	6,910	1.1
BsE	Brackett-Karnes complex, 1 to 12 percent slopes	8,780	1.4
BTF	Brackett soils, hilly	3,480	0.6
ChC	Chaney loamy sand, 1 to 5 percent slopes	67,310	10.8
ChC2	Chaney loamy sand, 1 to 5 percent slopes, eroded	21,980	3.5
ChD	Chaney loamy sand, 5 to 8 percent slopes	5,820	0.9
CmD	Chaney stony loamy sand, 1 to 8 percent slopes	2,320	0.4
CnD3	Chaney soils, 1 to 8 percent slopes, severely eroded	2,110	0.3
CoC	Cisco loamy fine sand, 1 to 5 percent slopes	3,300	0.5
Dc	Deleon clay, occasionally flooded	2,100	0.3
De	Deleon clay, frequently flooded	3,030	0.5
DmC	Demona loamy sand, 0 to 5 percent slopes	56,270	9.1
DnB	Denton silty clay, 1 to 3 percent slopes	11,440	1.9
DnC	Denton silty clay, 3 to 5 percent slopes	12,450	2.0
Ee	Energy fine sandy loam, occasionally flooded	3,310	0.5
Ef	Energy soils, frequently flooded	7,620	1.2
Fr	Frio clay loam, occasionally flooded	9,680	1.6
HaA	Hassee loam, 0 to 1 percent slopes	1,570	0.3
HaB	Hassee loam, 1 to 3 percent slopes	1,900	0.3
HdC	Heaton loamy fine sand, 0 to 5 percent slopes	3,880	0.6
HeB	Hensley loam, 1 to 3 percent slopes	2,940	0.5
HnB	Hensley stony loam, 0 to 3 percent slopes	2,650	0.4
KaC	Karnes loam, 1 to 5 percent slopes	10,850	1.7
KaD	Karnes loam, 5 to 8 percent slopes	5,100	0.8
KcA	Krum silty clay, 0 to 1 percent slopes	880	0.1
KcB	Krum silty clay, 1 to 3 percent slopes	12,010	1.9
La	Lamkin clay loam, occasionally flooded	2,430	0.4
Lb	Lamkin soils, frequently flooded	2,340	0.4
LcA	Leeray clay, 0 to 1 percent slopes	780	0.1
LcB	Leeray clay, 1 to 3 percent slopes	3,250	0.5
LeB	Lewisville clay loam, 1 to 3 percent slopes	7,420	1.2
LeC	Lewisville clay loam, 3 to 5 percent slopes	4,710	0.8
LuB	Luckenbach clay loam, 1 to 3 percent slopes	1,260	0.2
MfA	May fine sandy loam, 0 to 1 percent slopes	1,420	0.2
MfB	May fine sandy loam, 1 to 3 percent slopes	1,780	0.3
MnB	Menard fine sandy loam, 1 to 3 percent slopes	5,270	0.9
MnC	Menard fine sandy loam, 3 to 5 percent slopes	5,610	0.9
MnD	Menard fine sandy loam, 5 to 8 percent slopes	4,750	0.8
MsC2	Menard soils, 1 to 5 percent slopes, eroded	4,420	0.7
MsD3	Menard soils, 1 to 8 percent slopes, severely eroded	620	0.1
NmC	Nimrod fine sand, 0 to 5 percent slopes	21,120	3.4
OcC	Owens clay, 1 to 5 percent slopes	1,280	0.2
OwG	Owens stony clay, 3 to 25 percent slopes	2,800	0.5
PaC	Patilo-Nimrod complex, 0 to 5 percent slopes	13,520	2.2
PdC	Pedernales loamy fine sand, 1 to 5 percent slopes	15,960	2.6
PeB	Pedernales fine sandy loam, 1 to 3 percent slopes	10,800	1.7
PeC	Pedernales fine sandy loam, 3 to 5 percent slopes	3,060	0.5
PeD	Pedernales fine sandy loam, 5 to 8 percent slopes	3,830	0.6
PsC2	Pedernales soils, 1 to 5 percent slopes, eroded	20,920	3.4
PsD3	Pedernales soils, 1 to 8 percent slopes, severely eroded	3,030	0.5
PuB	Purves clay, 1 to 3 percent slopes	3,440	0.6
PuC	Purves clay, 3 to 5 percent slopes	2,480	0.4
PvG	Purves-Tarrant complex, 8 to 40 percent slopes	3,510	0.6
PXD	Purves-Bolar association, undulating	79,311	12.7
SuC	Sunev clay loam, 3 to 5 percent slopes	7,590	1.2
SuD	Sunev clay loam, 5 to 8 percent slopes	3,220	0.5
TAD	Tarrant association, undulating	30,320	4.9
TAF	Tarrant-Rock outcrop association, hilly	4,630	0.7

See footnote at end of table.

TABLE 2.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
TrA	Thurber clay loam, 0 to 1 percent slopes	1,110	0.2
TrB	Thurber clay loam, 1 to 3 percent slopes	2,790	0.4
TuB	Truce fine sandy loam, 1 to 3 percent slopes	2,750	0.4
TuC2	Truce fine sandy loam, 1 to 5 percent slopes, eroded	2,530	0.4
TxD	Truce-Bonti complex, 1 to 8 percent slopes	5,600	0.9
TyF	Truce-Rock outcrop complex, 8 to 20 percent slopes	1,400	0.2
VeB	Venus loam, 1 to 3 percent slopes	3,350	0.5
	Gravel pits	183	([1])
	Water	4,096	0.7
	Total	622,080	100.0

[1] Less than 0.1 percent.

TABLE 3.—YIELDS PER ACRE OF CROPS AND PASTURE PLANTS

[Yields in columns N are for nonirrigated soils; Those in columns I are for irrigated soils. All yields were estimated for a high level of management in 1974. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Peanuts		Grain sorghum		Oats		Improved bermudagrass	
	N	I	N	I	N	I	N	I
	Lb	Lb	Bu	Bu	Bu	Bu	AUM[1]	AUM[1]
Abilene:								
AbA	—	—	40	115	50	—	6.5	—
AbB	—	—	35	110	50	—	6.0	—
Bastrop:								
BaC	1,400	2,800	55	—	45	—	6.0	—
BbA	1,250	2,400	70	—	50	—	7.0	—
BbB	1,200	2,400	55	—	45	—	7.0	—
Bolar:								
BcB	—	—	40	—	40	—	5.0	—
BcC	—	—	35	—	35	—	5.0	—
BcD	—	—	30	—	20	—	4.5	—
Bonti:								
BnB	—	—	40	—	35	—	4.0	—
Bosque:								
Bo	—	—	65	—	60	—	6.5	—
Brackett:								
[2]BrC	—	—	—	—	26	—	2.9	—
[2]BsE	—	—	—	—	—	—	—	—
[2]BTF	—	—	—	—	—	—	—	—
Chaney:								
ChC	1,200	2,800	35	—	—	—	6.0	—
ChC2	800	2,400	30	—	—	—	5.0	—
ChD	—	—	30	—	—	—	5.0	—
CmD	—	—	—	—	—	—	—	—
CnD3	—	—	—	—	—	—	4.0	—
Cisco:								
CoC	1,400	2,800	40	—	—	—	6.0	—
Deleon:								
Dc	—	—	70	—	60	—	6.5	—
De	—	—	—	—	—	—	6.5	—
Demona:								
DmC	1,200	2,800	40	—	—	—	6.0	—
Denton:								
DnB	—	—	65	—	60	—	6.0	—
DnC	—	—	55	—	50	—	5.0	—
Energy:								
Ee	1,200	—	70	—	50	—	7.5	—
[2]Ef	—	—	—	—	—	—	7.5	—

See footnotes at end of table.

TABLE 3.--YIELDS PER ACRE OF CROPS AND PASTURE PLANTS--Continued

Soil name and map symbol	Peanuts		Grain sorghum		Oats		Improved bermudagrass	
	N	I	N	I	N	I	N	I
	Lb	Lb	Bu	Bu	Bu	Bu	AUM[1]	AUM[1]
Frio:								
Fr	—	—	75	—	60	—	7.0	—
Hassee:								
HaA	—	—	45	—	30	—	5.0	—
HaB	—	—	35	—	30	—	4.5	—
Heaton:								
HdC	1,200	2,800	40	—	35	—	5.5	—
Hensley:								
HeB	—	—	25	—	40	—	3.5	—
HnB	—	—	—	—	—	—	—	—
Karnes:								
KaC	—	—	25	45	30	—	3.0	6.0
KaD	—	—	20	—	30	—	3.0	—
Krum:								
KcA	—	—	75	—	70	—	7.0	—
KcB	—	—	70	—	70	—	7.0	—
Lamkin:								
La	—	—	70	—	60	—	7.0	—
[2]Lb	—	—	—	—	—	—	7.0	—
Leeray:								
LcA	—	—	55	—	40	—	4.0	—
LcB	—	—	45	—	40	—	4.0	—
Lewisville:								
LeB	—	—	70	—	70	—	7.5	—
LeC	—	—	65	—	60	—	7.0	—
Luckenbach:								
LuB	—	—	55	—	50	—	5.0	—
May:								
MfA	1,400	—	55	—	50	—	6.5	—
MfB	1,200	—	50	—	50	—	6.5	—
Menard:								
MnB	1,200	2,000	35	—	35	—	5.5	—
MnC	1,000	2,000	30	—	30	—	5.0	—
MnD	—	—	20	—	30	—	5.0	—
[2]MsC2	800	—	25	—	30	—	4.5	—
[2]MsD3	—	—	—	—	—	—	4.0	—
Nimrod:								
NmC	1,200	2,800	40	—	30	—	5.5	—
Owens:								
OcC	—	—	—	—	—	—	—	—

See footnotes at end of table.

TABLE 3.--YIELDS PER ACRE OF CROPS AND PASTURE PLANTS--Continued

Soil name and map symbol	Peanuts		Grain sorghum		Oats		Improved bermudagrass	
	N	I	N	I	N	I	N	I
	Lb	Lb	Bu	Bu	Bu	Bu	AUM[1]	AUM[1]
OwG	—	—	—	—	—	—	—	—
Patilo:								
[2]PaC	1,060	2,400	—	—	—	—	4.9	—
Pedernales:								
PdC	1,200	2,400	35	—	50	—	5.0	—
PeB	1,000	2,000	35	—	60	—	4.0	—
PeC	800	—	35	—	45	—	4.0	—
PeD	—	—	—	—	40	—	3.5	—
[2]PsC2	700	—	20	—	35	—	3.5	—
[2]PsD3	—	—	—	—	—	—	3.0	—
Purves:								
PuB	—	—	35	—	45	—	4.0	—
PuC	—	—	25	—	40	—	3.5	—
[2]PvG	—	—	—	—	—	—	—	—
[2]PXD:								
Purves part	—	—	—	—	—	—	—	—
Bolar part	—	—	—	—	—	—	—	—
Sunev:								
SuC	—	—	35	—	50	—	5.5	—
SuD	—	—	30	—	45	—	5.5	—
Tarrant:								
[2]TAD	—	—	—	—	—	—	—	—
[2]TAF:								
Tarrant part	—	—	—	—	—	—	—	—
Rock outcrop part	—	—	—	—	—	—	—	—
Thurber:								
TrA	—	—	30	—	35	—	3.5	—
TrB	—	—	30	—	35	—	3.5	—
Truce:								
TuB	—	—	35	—	30	—	4.0	—
TuC2	—	—	30	—	20	—	4.0	—
[2]TxD	—	—	—	—	—	—	—	—
[2]TyF	—	—	—	—	—	—	—	—
Venus:								
VeB	—	—	70	—	60	—	7.0	—

[1] Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for a period of 30 days.

[2] This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 4.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Soils not listed are not in range sites; such soils can be used for grazing if grass cover is established]

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lbs/ac		Pct
Abilene:					
AbA, AbB	Clay Loam	Favorable	6,000	Little bluestem	20
		Normal	5,000	Vine-mesquite	15
		Unfavorable	3,000	Sideoats grama	15
				Buffalograss	10
				Western wheatgrass	5
				Silver bluestem	5
				Texas wintergrass	5
				Tall dropseed	5
				White tridens	5
				Other annual grasses	5
				Other perennial grasses	5
				Other perennial forbs	5
Bastrop:					
BaC	Loamy Sand	Favorable	5,500	Little bluestem	50
		Normal	4,200	Yellow indiangrass	10
		Unfavorable	2,500	Switchgrass	5
				Purpletop	5
				Fall witchgrass	5
				Post oak	5
				Blackjack oak	5
				American beautyberry	5
				Other perennial forbs	5
				Other annual forbs	5
BbA, BbB	Sandy Loam	Favorable	5,000	Little bluestem	50
		Normal	4,000	Yellow indiangrass	10
		Unfavorable	2,000	Switchgrass	5
				Purpletop	5
				Sideoats grama	5
				Fall witchgrass	5
				Post oak	5
				Blackjack oak	5
				Hackberry	5
				Other perennial forbs	3
				Other annual forbs	2
Bolar:					
BcB, BcC, BcD	Clay Loam	Favorable	6,000	Little bluestem	20
		Normal	5,000	Yellow indiangrass	15
		Unfavorable	3,000	Big bluestem	10
				Sideoats grama	10
				Silver bluestem	5
				Tall dropseed	5
				Texas wintergrass	5
				Canada wildrye	5
				Other perennial forbs	15
				Other perennial grasses	5
				Other trees	5
Bonti:					
BnB	Sandy Loam	Favorable	4,500	Little bluestem	30
		Normal	3,500	Big bluestem	10
		Unfavorable	3,000	Yellow indiangrass	10
				Sideoats grama	10
				Silver bluestem	5
				Texas wintergrass	5
				Arizona cottontop	5
				Post oak	3
				Blackjack oak	2
				Winged elm	2
				Other perennial forbs	10
				Other annual grasses	5
				Other trees	3

See footnote at end of table.

TABLE 4.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lbs/ac		Pct
Bosque:					
Bo	Loamy Bottomland	Favorable	6,500	Yellow indiangrass	20
		Normal	5,000	Little bluestem	15
		Unfavorable	3,500	Switchgrass	15
				Big bluestem	10
				Sideoats grama	5
				Canada wildrye	5
				Vine-mesquite	5
				Texas wintergrass	5
				Tall dropseed	5
				Other trees	10
				Other perennial forbs	5
Brackett:					
[1]BrC:					
Brackett part	Adobe	Favorable	4,000	Little bluestem	40
		Normal	3,200	Sideoats grama	8
		Unfavorable	1,800	Tall grama	7
				Yellow indiangrass	5
				Silver bluestem	5
				Tall dropseed	3
				Purple threeawn	2
				Slim tridens	2
				Fall witchgrass	2
				Hairy grama	1
				Other perennial forbs	10
				Other trees	6
				Other perennial grasses	5
				Other shrubs	4
Bolar part	Clay Loam	Favorable	6,000	Little bluestem	20
		Normal	5,000	Yellow indiangrass	15
		Unfavorable	3,000	Big bluestem	10
				Sideoats grama	10
				Silver bluestem	5
				Tall dropseed	5
				Texas wintergrass	5
				Canada wildrye	5
				Other perennial forbs	15
				Other perennial grasses	5
				Other trees	5
[1]BsE:					
Brackett part	Adobe	Favorable	4,000	Little bluestem	40
		Normal	3,200	Sideoats grama	8
		Unfavorable	1,800	Tall grama	7
				Yellow indiangrass	5
				Silver bluestem	5
				Tall dropseed	3
				Purple threeawn	2
				Slim tridens	2
				Fall witchgrass	2
				Hairy grama	1
				Other perennial forbs	10
				Other trees	6
				Other perennial grasses	5
				Other shrubs	4
Karnes part	Clay Loam	Favorable	4,000	Little bluestem	35
		Normal	3,000	Yellow indiangrass	20
		Unfavorable	1,500	Sideoats grama	10
				Meadow dropseed	10
				Vine-mesquite	5
				Canada wildrye	5
				Texas wintergrass	5
				Live oak	3
				Other perennial forbs	4
				Other perennial grasses	3

See footnote at end of table.

TABLE 4.—RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES—Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lbs/ac		Pct
Brackett:					
[1]BTF	Steep Adobe	Favorable	3,000	Little bluestem	30
		Normal	2,200	Sideoats grama	10
		Unfavorable	1,500	Tall grama	10
				Yellow indiangrass	10
				Tall dropseed	5
				Silver bluestem	5
				Slim tridens	5
				Hairy grama	5
				Other trees	15
				Other perennial forbs	5
Chaney:					
ChC, ChC2, ChD, CmD, CnD3	Loamy Sand	Favorable	4,500	Little bluestem	25
		Normal	4,000	Big bluestem	10
		Unfavorable	3,000	Yellow indiangrass	10
				Post oak	10
				Silver bluestem	5
				Scribner panicum	5
				Sand lovegrass	5
				Purpletop	5
				Other perennial grasses	15
				Other trees	5
				Other perennial forbs	5
Cisco:					
CoC	Loamy Sand	Favorable	4,500	Little bluestem	25
		Normal	4,000	Big bluestem	10
		Unfavorable	3,000	Yellow indiangrass	10
				Post oak	10
				Silver bluestem	5
				Scribner panicum	5
				Sand lovegrass	5
				Tall dropseed	5
				Purpletop	5
				Other perennial grasses	10
				Other trees	5
				Other perennial forbs	5
Deleon:					
Dc, De	Clayey Bottomland	Favorable	5,000	Vine-mesquite	25
		Normal	4,000	Texas wintergrass	15
		Unfavorable	3,000	White tridens	10
				Canada wildrye	10
				Little bluestem	10
				Arizona cottontop	10
				Buffalograss	5
				Yellow indiangrass	5
				Other trees	5
				Other perennial forbs	5
Demona:					
DmC	Sandy	Favorable	4,500	Little bluestem	25
		Normal	3,500	Big bluestem	10
		Unfavorable	2,000	Yellow indiangrass	10
				Post oak	8
				Blackjack oak	7
				Sand lovegrass	5
				Purpletop	5
				Tall dropseed	5
				Silver bluestem	5
				Scribner panicum	5
				Other perennial grasses	5
				Other trees	5
				Other perennial forbs	5

See footnote at end of table.

TABLE 4.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lbs/ac		Pct
Denton:					
DnB, DnC	Clay Loam	Favorable	6,500	Little bluestem	20
		Normal	5,000	Yellow indiangrass	15
		Unfavorable	3,000	Sideoats grama	10
				Big bluestem	10
				Switchgrass	5
				Silver bluestem	5
				Texas wintergrass	5
				Tall dropseed	5
				Other perennial forbs	15
				Other perennial grasses	5
				Other trees	5
Energy:					
Ee, [1]Ef	Loamy Bottomland	Favorable	6,500	Yellow indiangrass	20
		Normal	5,000	Switchgrass	15
		Unfavorable	3,500	Big bluestem	10
				Little bluestem	10
				Tall dropseed	5
				Texas wintergrass	5
				Sideoats grama	5
				Vine-mesquite	5
				Other perennial grasses	10
				Other trees	10
				Other perennial forbs	5
Frio:					
Fr	Loamy Bottomland	Favorable	5,500	Big bluestem	10
		Normal	4,000	Little bluestem	10
		Unfavorable	3,000	Vine-mesquite	10
				Switchgrass	5
				Yellow indiangrass	5
				Eastern gamagrass	5
				Texas wintergrass	5
				Plains lovegrass	5
				Canada wildrye	5
				Cane bluestem	5
				Southwestern bristlegrass	5
				Other trees	15
				Other perennial grasses	10
				Other perennial forbs	5
Hassee:					
HaA, HaB	Claypan Prairie	Favorable	4,000	Vine-mesquite	20
		Normal	3,000	Sideoats grama	10
		Unfavorable	2,000	Arizona cottontop	10
				Buffalograss	5
				Blue grama	5
				Texas wintergrass	5
				Tall dropseed	5
				Sand dropseed	5
				Purple threeawn	5
				Silver bluestem	5
				Other perennial grasses	15
				Other perennial forbs	5
				Other annual grasses	5
Heaton:					
HdC	Sandy	Favorable	4,500	Little bluestem	25
		Normal	3,500	Big bluestem	10
		Unfavorable	2,000	Yellow indiangrass	10
				Post oak	8
				Blackjack oak	7
				Sand lovegrass	5
				Purpletop	5
				Tall dropseed	5
				Silver bluestem	5
				Scribner panicum	5
				Other perennial grasses	5
				Other trees	5
				Other perennial forbs	5

See footnote at end of table.

TABLE 4.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lbs/ac		Pct
Hensley: HeB, HnB	Redland	Favorable	5,000	Little bluestem	30
		Normal	4,000	Yellow indiangrass	20
		Unfavorable	2,500	Sideoats grama	10
				Big bluestem	5
				Silver bluestem	5
				Switchgrass	5
				Blue grama	5
				Other perennial forbs	10
				Other perennial grasses	5
				Other shrubs	5
Karnes: KaC, KaD	Clay Loam	Favorable	4,000	Little bluestem	35
		Normal	3,000	Yellow indiangrass	20
		Unfavorable	1,500	Sideoats grama	10
				Meadow dropseed	10
				Vine-mesquite	5
				Canada wildrye	5
				Texas wintergrass	5
				Live oak	3
				Other perennial forbs	4
				Other perennial grasses	3
Krum: KcA, KcB	Clay Loam	Favorable	6,500	Little bluestem	50
		Normal	6,000	Big bluestem	15
		Unfavorable	4,000	Yellow indiangrass	10
				Eastern gamagrass	4
				Switchgrass	4
				Sideoats grama	4
				Virginia wildrye	4
				Vine-mesquite	4
				Unknowns	5
Lamkin: La, [1]Lb	Loamy Bottomland	Favorable	6,500	Yellow indiangrass	20
		Normal	5,000	Switchgrass	15
		Unfavorable	3,500	Big bluestem	10
				Little bluestem	10
				Tall dropseed	5
				Texas wintergrass	5
				Sideoats grama	5
				Vine-mesquite	5
				Other trees	10
				Other perennial grasses	10
				Other perennial forbs	5
Leeray: LcA, LcB	Clay Loam	Favorable	4,500	Sideoats grama	25
		Normal	3,500	Vine-mesquite	20
		Unfavorable	2,500	Silver bluestem	10
				Buffalograss	10
				Texas wintergrass	10
				White tridens	5
				Tall dropseed	5
				Other perennial forbs	9
				Other perennial grasses	5
				Other trees	1

See footnote at end of table.

TABLE 4.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lbs/ac		Pct
Lewisville:					
LeB, LeC	Clay Loam	Favorable	6,500	Little bluestem	20
		Normal	5,500	Yellow indiangrass	15
		Unfavorable	3,500	Big bluestem	15
				Switchgrass	10
				Texas wintergrass	5
				Virginia wildrye	5
				Silver bluestem	5
				Meadow dropseed	5
				Buffalograss	5
				Sideoats grama	5
				Other perennial forbs	5
				Other trees	5
Luckenbach:					
LuB	Clay Loam	Favorable	5,000	Little bluestem	30
		Normal	4,000	Sideoats grama	15
		Unfavorable	3,000	Yellow indiangrass	10
				Vine-mesquite	10
				Big bluestem	5
				Canada wildrye	5
				Texas wintergrass	5
				Silver bluestem	5
				Live oak	5
				Orange zexmania	3
				Engelmanndaisy	2
				Other perennial forbs	5
May:					
MfA, MfB	Sandy Loam	Favorable	6,000	Little bluestem	30
		Normal	5,000	Big bluestem	10
		Unfavorable	3,500	Yellow indiangrass	10
				Sideoats grama	5
				Silver bluestem	5
				Scribner panicum	5
				Texas wintergrass	5
				Arizona cottontop	5
				Post oak	4
				Other perennial forbs	10
				Other trees	6
				Other perennial grasses	5
Menard:					
MnB, MnC, MnD, [1]MsC2, [1]MsD3	Sandy Loam	Favorable	5,000	Little bluestem	30
		Normal	4,000	Big bluestem	10
		Unfavorable	3,000	Yellow indiangrass	10
				Sideoats grama	5
				Silver bluestem	5
				Scribner panicum	5
				Texas wintergrass	5
				Arizona cottontop	5
				Post oak	4
				Other perennial forbs	10
				Other trees	6
				Other perennial grasses	5
Nimrod:					
NmC	Sandy	Favorable	4,500	Little bluestem	25
		Normal	3,500	Big bluestem	10
		Unfavorable	2,000	Yellow indiangrass	10
				Post oak	8
				Blackjack oak	7
				Sand lovegrass	5
				Purpletop	5
				Tall dropseed	5
				Silver bluestem	5
				Scribner panicum	5
				Other perennial grasses	5
				Other trees	5
				Other perennial forbs	5

See footnote at end of table.

TABLE 4.--RANGELAND PRODUCTIVITY AND CHARACTERISITIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lbs/ac		Pct
Owens:					
OcC	Shallow Clay	Favorable	2,500	Sideoats grama	30
		Normal	2,000	Silver bluestem	15
		Unfavorable	1,000	Buffalograss	10
				Vine-mesquite	10
				Texas wintergrass	5
				Arizona cottontop	5
				Hairy grama	5
				Rough tridens	5
				Other perennial grasses	5
				Other perennial forbs	5
				Other shrubs	5
OwG	Rocky Hills	Favorable	1,200	Sideoats grama	30
		Normal	1,200	Silver bluestem	15
		Unfavorable	900	Buffalograss	10
				Vine-mesquite	10
				Texas wintergrass	5
				Arizona cottontop	5
				Hairy grama	5
				Rough tridens	5
				Other perennial grasses	5
				Other perennial forbs	5
				Other shrubs	5
Patilo: [1]PaC:					
Patilo part	Deep Sand	Favorable	3,000	Post oak	15
		Normal	2,000	Sand lovegrass	10
		Unfavorable	1,000	Blackjack oak	10
				Purpletop	5
				Little bluestem	5
				Red lovegrass	5
				Scribner panicum	5
				Fringeleaf paspalum	5
				Other perennial forbs	15
				Other trees	15
				Other annual grasses	10
Nimrod part	Sandy	Favorable	4,500	Little bluestem	25
		Normal	3,500	Big bluestem	10
		Unfavorable	2,000	Yellow indiangrass	10
				Post oak	8
				Blackjack oak	7
				Sand lovegrass	5
				Purpletop	5
				Tall dropseed	5
				Silver bluestem	5
				Scribner panicum	5
				Other perennial grasses	5
				Other trees	5
				Other perennial forbs	5
Pedernales:					
PdC	Loamy Sand	Favorable	4,000	Little bluestem	40
		Normal	3,500	Sand lovegrass	15
		Unfavorable	2,000	Sideoats grama	5
				Canada wildrye	5
				Yellow indiangrass	5
				Purpletop	5
				Fringeleaf paspalum	5
				Other trees	15
				Other perennial forbs	5
PeB, PeC, PeD, [1]PsC2, [1]PsD3	Tight Sandy Loam	Favorable	3,500	Sideoats grama	25
		Normal	3,000	Little bluestem	15
		Unfavorable	1,500	Pinhole bluestem	10
				Vine-mesquite	10
				Arizona cottontop	5
				Canada wildrye	5
				Texas wintergrass	5
				Other perennial grasses	10
				Other trees	10
				Other perennial forbs	5

See footnote at end of table.

TABLE 4.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lbs/ac		Pct
Purves:					
PuB, PuC	Shallow	Favorable	3,000	Little bluestem	30
		Normal	2,500	Yellow indiangrass	15
		Unfavorable	1,800	Big bluestem	10
				Sideoats grama	10
				Switchgrass	5
				Hairy grama	5
				Texas wintergrass	5
				Silver bluestem	5
				Other perennial grasses	5
				Other perennial forbs	5
				Other trees	5
[1]PvG:					
Purves part	Shallow	Favorable	3,000	Little bluestem	30
		Normal	2,500	Yellow indiangrass	15
		Unfavorable	1,800	Big bluestem	10
				Sideoats grama	10
				Switchgrass	5
				Hairy grama	5
				Texas wintergrass	5
				Silver bluestem	5
				Other perennial grasses	5
				Other perennial forbs	5
				Other trees	5
Tarrant part	Steep Rocky	Favorable	1,800	Sideoats grama	20
		Normal	1,400	Silver bluestem	15
		Unfavorable	800	Little bluestem	10
				Green sprangletop	10
				Yellow indiangrass	5
				Fall witchgrass	5
				Live oak	5
				Other perennial grasses	10
				Other shrubs	10
				Other perennial forbs	10
[1]PXD:					
Purves part	Shallow	Favorable	3,000	Little bluestem	30
		Normal	2,500	Yellow indiangrass	15
		Unfavorable	1,800	Big bluestem	10
				Sideoats grama	10
				Switchgrass	5
				Hairy grama	5
				Texas wintergrass	5
				Silver bluestem	5
				Other perennial grasses	5
				Other perennial forbs	5
				Other trees	5
Bolar part	Clay Loam	Favorable	6,000	Little bluestem	20
		Normal	5,000	Yellow indiangrass	15
		Unfavorable	3,000	Big bluestem	10
				Sideoats grama	10
				Silver bluestem	5
				Tall dropseed	5
				Texas wintergrass	5
				Canada wildrye	5
				Other perennial forbs	15
				Other perennial grasses	5
				Other trees	5

See footnote at end of table.

TABLE 4.—RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES—Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lbs/ac		Pct
Sunev: SuC, SuD	Clay Loam	Favorable	7,000	Little bluestem	50
		Normal	5,500	Yellow indiangrass	15
		Unfavorable	3,500	Big bluestem	10
				Live oak	3
				Eastern gamagrass	2
				Switchgrass	2
				Sideoats grama	2
				Vine-mesquite	2
				Buffalograss	2
				Other perennial forbs	5
				Other annual forbs	5
				Other trees	2
Tarrant: [1]TAD	Low Stony Hills	Favorable	2,500	Little bluestem	15
		Normal	1,800	Sideoats grama	15
		Unfavorable	1,200	Curlymesquite	10
				Buffalograss	5
				Green sprangletop	5
				Texas wintergrass	5
				Texas cupgrass	5
				Tall dropseed	5
				Silver bluestem	5
				Live oak	5
				Other perennial grasses	10
				Other perennial forbs	10
				Other shrubs	5
TAF	Steep Rocky	Favorble	1,800	Sideoats grama	20
		Normal	1,400	Silver bluestem	15
		Unfavorable	800	Little bluestem	10
				Green sprangletop	10
				Yellow indiangrass	5
				Fall witchgrass	5
				Live oak	5
				Other perennial grasses	10
				Other shrubs	10
				Other perennial forbs	10
Thurber: TrA, TrB	Claypan Prairie	Favorable	3,500	Vine-mesquite	20
		Normal	3,000	Sideoats grama	10
		Unfavorable	2,000	Arizona cottontop	10
				Buffalograss	5
				Blue grama	5
				Texas wintergrass	5
				Tall dropseed	5
				Sand dropseed	5
				Purple threeawn	5
				Silver bluestem	5
				Other perennial grasses	15
				Other perennial forbs	5
				Other annual grasses	5
Truce: TuB, TuC2	Tight Sandy Loam	Favorable	4,000	Sideoats grama	30
		Normal	3,000	Arizona cottontop	15
		Unfavorable	2,000	Vine-mesquite	15
				Little bluestem	5
				Silver bluestem	5
				Buffalograss	5
				Texas wintergrass	5
				Other perennial grasses	10
				Other trees	5
				Other perennial forbs	5

See footnote at end of table.

TABLE 4.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lbs/ac		Pct
Truce:					
[1]TxD:					
Truce part	Tight Sandy Loam	Favorable	4,000	Sideoats grama	30
		Normal	3,000	Arizona cottontop	15
		Unfavorable	2,000	Vine-mesquite	15
				Little bluestem	5
				Silver bluestem	5
				Buffalograss	5
				Texas wintergrass	5
				Other perennial grasses	10
				Other perennial forbs	5
				Other trees	5
Bonti part	Sandy Loam	Favorable	4,500	Little bluestem	30
		Normal	3,500	Big bluestem	10
		Unfavorable	3,000	Yellow indiangrass	10
				Sideoats grama	10
				Silver bluestem	5
				Texas wintergrass	5
				Arizona cottontop	5
				Post oak	3
				Blackjack oak	2
				Winged elm	2
				Other perennial forbs	10
				Other annual grasses	5
				Other trees	3
Truce:					
[1]TyF:					
Truce part	Sandstone Hills	Favorable	4,000	Little bluestem	30
		Normal	3,000	Sideoats grama	15
		Unfavorable	2,500	Yellow indiangrass	10
				Big bluestem	5
				Switchgrass	5
				Sand lovegrass	5
				Other trees	15
				Other annual grasses	10
				Other perennial forbs	5
Venus:					
VeB	Clay Loam	Favorable	6,500	Little bluestem	20
		Normal	5,000	Yellow indiangrass	15
		Unfavorable	3,000	Big bluestem	10
				Sideoats grama	10
				Silver bluestem	5
				Tall dropseed	5
				Texas wintergrass	5
				Canada wildrye	5
				Other perennial forbs	15
				Other perennial grasses	5
				Other trees	5

---

[1] This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 5.—BUILDING SITE DEVELOPMENT

["Shrink-swell," and other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe". Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Abilene:					
AbA, AbB	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
Bastrop:					
BaC, BbA, BbB	Slight	Slight	Slight	Slight	Moderate: low strength.
Bolar:					
BcB	Moderate: depth to rock.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Severe: low strength.
BcC, BcD	Moderate: depth to rock.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength, slope.	Severe: low strength.
Bonti:					
BnB	Severe: depth to rock.	Moderate: depth to rock, shrink-swell.	Severe: depth to rock.	Moderate: depth to rock.	Severe: low strength.
Bosque:					
Bo	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Brackett:					
[1]BrC:					
Brackett part	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.
Bolar part	Moderate: depth to rock.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Severe: low strength.
[1]BsE:					
Brackett part	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.
Karnes part	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
[1]BTF	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: slope.	Moderate: depth to rock.
Chaney:					
ChC, ChC2	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
ChD, CnD3	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
CmD	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: low strength.
Cisco:					
CoC	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength.
Deleon:					
Dc, De	Severe: too clayey, floods.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.

See footnote at end of table.

TABLE 5.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Demona:					
DmC	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: shrink-swell.
Denton:					
DnB, DnC	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.
Energy:					
Ee	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
[1]Ef	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Frio:					
Fr	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
Hassee:					
HaA, HaB	Severe: too clayey, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell.
Heaton:					
HdC	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Hensley:					
HeB, HnB	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Karnes:					
KaC	Slight	Slight	Slight	Slight	Moderate: low strength.
KaD	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
Krum:					
KcA, KcB	Severe: cutbanks cave, too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
Lamkin:					
La	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
[1]Lb	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
Leeray:					
LcA, LcB	Severe: cutbanks cave, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.
Lewisville:					
LeB, LeC	Moderate: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
Luckenbach:					
LuB	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.

See footnote at end of table.

TABLE 5.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
May:					
MfA, MfB	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength.
Menard:					
MnB, [1]MsC2	Slight	Slight	Slight	Slight	Moderate: low strength.
MnC, MnD, [1]MsD3	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
Nimrod:					
NmC	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Slight.
Owens:					
OcC	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.
OwG	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell.
Patilo:					
[1]PaC:					
Patilo part	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight.
Nimrod part	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Slight.
Pedernales:					
PdC, PeB, PeC, PeD, [1]PsC2, [1]PsD3	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.
Purves:					
PuB, PuC	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
[1]PvG:					
Purves part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope.
Tarrant part	Severe: depth to rock.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.
[1]PXD:					
Purves part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Bolar part	Moderate: depth to rock.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength, slope.	Severe: low strength.
Sunev:					
SuC, SuD	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
Tarrant:					
[1]TAD	Severe: depth to rock.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.

See footnote at end of table.

TABLE 5.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
[1]TAF:					
Tarrant part.	Severe: depth to rock.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.
Tarrant: Rock outcrop part.					
Thurber: TrA, TrB	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.
Truce: TuB, TuC2	Severe: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
[1]TxD:					
Truce part	Severe: too clayey, large stones.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Bonti part	Severe: depth to rock.	Moderate: depth to rock, shrink-swell.	Moderate: depth to rock, shrink-swell.	Severe: large stones.	Severe: low strength.
[1]TyF:					
Truce part	Severe: too clayey, large stones.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: slope.	Severe: low strength.
Rock outcrop part.					
Venus: VeB	Slight	Slight	Slight	Slight	Moderate: low strength.

[1] This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 6.—SANITARY FACILITIES

["Shrink-swell" and other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe," and other terms used to rate soils. Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Abilene:					
AbA	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
AbB	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Bastrop:					
BaC, BbA, BbB	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Bolar:					
BcB, BcC, BcD	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Fair: too clayey.
Bonti:					
BnB	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Fair: depth to rock.
Bosque:					
Bo	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
Brackett:					
[1]BrC:					
Brackett part	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer.
Bolar part	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Fair: too clayey.
[1]BsE:					
Brackett part	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer.
Karnes part	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
[1]BTF	Severe: percs slowly, depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer.
Chaney:					
ChC, ChC2, ChD, CnD3	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Poor: thin layer.
CmD	Severe: percs slowly.	Moderate: slope, large stones.	Severe: large stones.	Slight	Poor: thin layer, large stones.
Cisco:					
CoC	Slight	Moderate: seepage, slope.	Severe: seepage.	Slight	Good.
Deleon:					
Dc, De	Severe: percs slowly, floods.	Severe: floods.	Severe: too clayey, floods.	Severe: floods.	Poor: too clayey.

See footnote at end of table.

TABLE 6.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Demona:					
DmC	Severe: percs slowly.	Severe: seepage.	Moderate: wetness.	Severe: wetness.	Fair: too sandy.
Denton:					
DnB, DnC	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: too clayey, depth to rock.	Slight	Poor: too clayey.
Energy:					
Ee	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
[1]Ef	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
Frio:					
Fr	Severe: floods, percs slowly.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
Hassee:					
HaA	Severe: percs slowly.	Slight	Severe: too clayey, wetness.	Severe: wetness.	Poor: thin layer.
HaB	Severe: percs slowly.	Moderate: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: thin layer.
Heaton:					
HdC	Slight	Moderate: seepage.	Slight	Slight	Fair: too sandy.
Hensley:					
HeB, HnB	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer.
Karnes:					
KaC, KaD	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Krum:					
KcA	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
KcB	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Lamkin:					
La	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
[1]Lb	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
Leeray:					
LcA	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
LcB	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Lewisville:					
LeB, LeC	Moderate: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight	Fair: too clayey.
Luckenbach:					
LuB	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Poor: thin layer.

See footnote at end of table.

TABLE 6.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
May:					
MfA	Slight	Moderate: seepage.	Slight	Slight	Good.
MfB	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Menard:					
MnB, MnC, MnD, [1]MsC2, [1]MsD3	Slight	Moderate: seepage, slope.	Severe: seepage.	Slight	Good.
Nimrod:					
NmC	Severe: percs slowly.	Severe: seepage.	Moderate: wetness.	Severe: wetness.	Fair: too sandy.
Owens:					
OcC	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, area reclaim.
OwG	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, area reclaim.
Patilo:					
[1]PaC:					
Patilo part	Moderate: percs slowly.	Severe: seepage.	Moderate: too sandy, wetness.	Moderate: seepage.	Poor: too sandy.
Nimrod part	Severe: percs slowly.	Severe: seepage.	Moderate: wetness.	Severe: wetness.	Fair: too sandy.
Pedernales:					
PdC, PeB, PeC, PeD, [1]PsC2, [1]PsD3	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Purves:					
PuB, PuC	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, too clayey.
[1]PvG:					
Purves part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: thin layer, too clayey.
Tarrant part	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: slope.	Poor: thin layer, large stones, too clayey.
[1]PXD:					
Purves part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, too clayey.
Bolar part	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Fair: too clayey.
Sunev:					
SuC, SuD	Slight	Severe: seepage.	Slight	Slight	Fair: excess lime.

See footnote at end of table.

TABLE 6.—SANITARY FACILITIES—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Tarrant:					
[1]TAD	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, large stones, too clayey.
[1]TAF:					
Tarrant part	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: slope.	Poor: thin layer, large stones, too clayey,
Rock outcrop part.					
Thurber:					
TrA	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
TrB	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Truce:					
TuB, TuC2	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: thin layer.
[1]TxD:					
Truce part	Severe: percs slowly.	Moderate: large stones, slope.	Severe: too clayey, large stones.	Slight	Poor: thin layer, large stones.
Bonti part	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: large stones.
[1]TyF:					
Truce part	Severe: percs slowly.	Severe: slope, large stones.	Severe: too clayey, large stones.	Moderate: slope.	Poor: thin layer, large stones.
Rock outcrop part.					
Venus:					
VeB	Slight	Moderate: seepage.	Slight	Slight	Good.

---

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 7.—CONSTRUCTION MATERIALS

["Shrink-swell" and other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Abilene:				
AbA, AbB	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Bastrop:				
BaC	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
BbA, BbB	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Bolar:				
BcB, BcC, BcD	Poor: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: excess lime.
Bonti:				
BnB	Poor: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Bosque:				
Bo	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Brackett:				
[1]BrC:				
Brackett part	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess lime.
Bolar part	Poor: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: excess lime.
[1]BsE:				
Brackett part	Poor. thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess lime.
Karnes part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess lime.
[1]BTF	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess lime.
Chaney:				
ChC, ChC2, ChD, CnD3	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
CmD	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy, large stones.
Cisco:				
CoC	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Deleon:				
Dc, De	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Demona:				
DmC	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.

See footnote at end of table.

TABLE 7.—CONSTRUCTION MATERIALS—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Denton: DnB, DnC	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Energy: Ee, [1]Ef	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Frio: Fr	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Hassee: HaA, HaB	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Heaton: HdC	Good	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Hensley: HeB	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
HnB	Poor: thin layer.	Unsuited: excess fine.	Unsuited: excess fines.	Poor: large stones.
Karnes: KaC, KaD	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess lime.
Krum: KcA, KcB	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Lamkin: La, [1]Lb	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Leeray: LcA, LcB	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Lewisville: LeB, LeC	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Luckenbach: LuB	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
May: MfA, MfB	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Menard: MnB, MnC, MnD, [1]MsC2, [1]MsD3	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Nimrod: NmC	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Owens: OcC, OwG	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 7.—CONSTRUCTION MATERIALS—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Patilo:				
[1]PaC:				
Patilo part	Good	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Nimrod part	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Pedernales:				
PdC	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
PeB, PeC, PeD, [1]PsC2, [1]PsD3	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Purves:				
PuB, PuC	Poor: shrink-swell, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, thin layer.
[1]PvG:				
Purves part	Poor: shrink-swell, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, thin layer.
Tarrant part	Poor: thin layer, large stones.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, large stones.
[1]PXD:				
Purves part	Poor: shrink-swell, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, thin layer.
Bolar part	Poor: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.
Sunev:				
SuC, SuD	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: excess lime.
Tarrant:				
[1]TAD	Poor: thin layer, large stones.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, large stones.
[1]TAF:				
Tarrant part	Poor: thin layer, large stones.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, large stones.
Rock outcrop part.				
Thurber:				
TrA, TrB	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
Truce:				
TuB, TuC2	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
[1]TxD:				
Truce part	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.

See footnote at end of table.

TABLE 7.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Truce:				
Bonti part	Poor: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.
[1]TyF:				
Truce part	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.
Rock outcrop part.				
Venus:				
VeB	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.

[1] This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 8.—WATER MANAGEMENT

["Seepage," "slope," and other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not evaluated]

Soil name and map symbol	Limitations for—		Features affecting—			
	Pond reservoir areas	Embankments dikes and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Abilene:						
AbA, AbB	Moderate: seepage.	Moderate: piping, compressible.	Not needed	Slow intake	Favorable	Favorable.
Bastrop:						
BaC, BbA, BbB	Moderate: seepage.	Moderate: piping.	Not needed	Favorable	Favorable	Favorable.
Bolar:						
BcB, BcC	Severe: seepage	Moderate: thin layer.	Depth to rock	Excess lime	Favorable	Favorable.
BcD	Severe: seepage.	Moderate: thin layer.	Depth to rock	Excess lime	Slope	Favorable.
Bonti:						
BnB	Severe: depth to rock.	Moderate: thin layer.	Not needed	Slow intake	Favorable	Favorable.
Bosque:						
Bo	Moderate: seepage.	Moderate: compressible.	Not needed	Favorable	Floods	Floods.
Brackett:						
[1]BrC:						
Brackett part	Severe: seepage.	Severe: thin layer.	Depth to rock	Droughty, excess lime, rooting depth.	Depth to rock, rooting depth.	Droughty, rooting depth.
Bolar part	Severe: seepage.	Moderate: thin layer.	Depth to rock	Excess lime	Favorable	Favorable.
[1]BsE:						
Brackett part	Severe: seepage.	Severe: thin layer.	Depth to rock	Droughty, excess lime, rooting depth.	Depth to rock, rooting depth.	Droughty, rooting depth.
Karnes part	Severe: seepage.	Moderate: piping, erodes easily.	Not needed	Fast intake, excess lime.	Piping, erodes easily.	Erodes easily.
[1]BTF	Severe: seepage.	Severe: thin layer.	Depth to rock	Droughty, excess lime, rooting depth.	Depth to rock, rooting depth.	Droughty, rooting depth.
Chaney:						
ChC, ChC2, ChD, CnD3	Slight	Moderate: erodes easily.	Percs slowly	Percs slowly, soil blowing.	Piping, erodes easily.	Erodes easily.
CmD	Slight	Moderate: erodes easily.	Percs slowly	Percs slowly, soil blowing.	Large stones, piping, erodes easily.	Large stones, erodes easily.
Cisco:						
CoC	Moderate: seepage.	Moderate: erodes easily.	Not needed	Soil blowing, erodes easily.	Soil blowing, erodes easily.	Erodes easily.
Deleon:						
Dc, De	Slight	Moderate: compressible.	Percs slowly	Slow intake, percs slowly.	Floods	Floods.
Demona:						
DmC	Moderate: seepage.	Moderate: erodes easily.	Cutbanks cave, percs slowly.	Fast intake, soil blowing.	Piping, erodes easily.	Erodes easily.

See footnote at end of table.

TABLE 8.—WATER MANAGEMENT—Continued

Soil name and map symbol	Limitations for—		Features affecting—			
	Pond reservoir areas	Embankments dikes and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Denton: DnB, DnC	Severe: depth to rock.	Moderate: compressible, shrink-swell.	Not needed	Percs slowly	Favorable	Favorable.
Energy: Ee	Severe: seepage.	Moderate: piping.	Not needed	Floods	Floods	Floods.
[1]Ef	Severe: seepage.	Moderate: piping.	Not needed	Floods	Floods	Floods.
Frio: Fr	Moderate: seepage.	Moderate: compressible.	Not needed	Floods	Favorable	Favorable.
Hassee: HaA, HaB	Slight	Moderate: unstable fill.	Percs slowly	Slow intake	Percs slowly	Droughty, percs slowly.
Heaton: HdC	Moderate: seepage.	Moderate: erodes easily.	Not needed	Fast intake, soil blowing.	Piping, erodes easily.	Droughty, erodes easily.
Hensley: HeB, HnB	Severe: depth to rock.	Severe: thin layer.	Not needed	Rooting depth, slow intake.	Depth to rock	Percs slowly, rooting depth.
Karnes: KaC, KaD	Severe: seepage.	Moderate: piping, erodes easily.	Not needed	Fast intake, excess lime.	Piping, erodes easily.	Erodes easily.
Krum: KcA, KcB	Moderate: seepage.	Moderate: low strength.	Not needed	Slow intake	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Lamkin: La	Severe: seepage.	Moderate: piping.	Not needed	Floods	Floods	Floods.
[1]Lb	Severe: seepage.	Moderate: piping.	Not needed	Floods	Floods	Floods.
Leeray: LcA, LcB	Slight	Moderate: unstable fill.	Not needed	Slow intake, percs slowly.	Percs slowly	Percs slowly.
Lewisville: LeB, LeC	Moderate: seepage.	Moderate: unstable fill.	Favorable	Favorable	Favorable	Favorable.
Luckenbach: LuB	Moderate: seepage.	Moderate: compressible.	Not needed	Favorable	Favorable	Favorable.
May: MfA, MfB	Moderate: seepage.	Moderate: erodes easily.	Not needed	Favorable	Favorable	Favorable.
Menard: MnB, MnC, MnD, [1]MsC2, [1]MsD3	Moderate: seepage.	Moderate: erodes easily.	Not needed	Erodes easily	Erodes easily	Erodes easily.
Nimrod: NmC	Moderate: seepage.	Moderate: erodes easily.	Cutbanks cave	Fast intake, soil blowing.	Piping, erodes easily.	Erodes easily.
Owens: OcC	Slight	Moderate: compressible.	Not needed	Droughty, percs slowly.	Rooting depth, percs slowly.	Droughty, erodes easily.

See footnote at end of table.

TABLE 8.—WATER MANAGEMENT—Continued

Soil name and map symbol	Limitations for—		Features affecting—			
	Pond reservoir areas	Embankments dikes and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Owens:						
OwG	Slight	Moderate: compressible.	Not needed	Droughty, percs slowly.	Slope, rooting depth.	Droughty, erodes easily.
Patilo:						
[1]PaC:						
Patilo part	Severe: seepage.	Moderate: seepage, piping.	Cutbanks cave	Fast intake, soil blowing.	Piping, erodes easily.	Droughty.
Nimrod part	Moderate: seepage.	Moderate: erodes easily.	Cutbanks cave	Fast intake, soil blowing.	Piping, erodes easily.	Erodes easily.
Pedernales:						
PdC, PeB, PeC, PeD, [1]PsC2, [1]PsD3	Moderate: seepage.	Moderate: compressible.	Percs slowly	Percs slowly	Favorable	Favorable.
Purves:						
PuB, PuC	Severe: depth to rock.	Severe: thin layer.	Depth to rock	Droughty, rooting depth.	Depth to rock	Rooting depth, droughty.
[1]PvG:						
Purves part	Severe: depth to rock.	Severe: thin layer.	Depth to rock	Rooting depth, droughty.	Depth to rock, rooting depth.	Droughty, rooting depth.
Tarrant part	Severe: depth to rock.	Severe: thin layer, large stones.	Depth to rock	Rooting depth	Depth to rock, large stones.	Rooting depth, large stones.
[1]PXD:						
Purves part	Severe: depth to rock.	Severe: thin layer.	Depth to rock	Rooting depth, droughty.	Depth to rock, rooting depth.	Droughty, rooting depth.
Bolar part	Severe: seepage.	Moderate: thin layer.	Depth to rock	Excess lime	Large stones	Large stones.
Sunev:						
SuC, SuD	Severe: seepage.	Moderate: compressible, piping.	Not needed	Excess lime	Favorable	Favorable.
Tarrant:						
[1]TAD	Severe: depth to rock.	Severe: thin layer, large stones.	Depth to rock	Rooting depth	Depth to rock, large stones.	Rooting depth, large stones.
[1]TAF:						
Tarrant part	Severe: depth to rock.	Severe: thin layer, large stones.	Depth to rock	Rooting depth	Depth to rock, large stones.	Rooting depth, large stones.
Rock outcrop part.						
Thurber:						
TrA, TrB	Slight	Moderate: compressible.	Percs slowly	Slow intake	Percs slowly	Droughty, percs slowly.
Truce:						
TuB, TuC2	Slight	Moderate: low strength.	Not needed	Percs slowly	Favorable	Favorable.
[1]TxD:						
Truce part	Slight	Moderate: large stones.	Not needed	Slow intake, complex slope.	Large stones	Large stones.
Bonti part	Severe: depth to rock.	Severe: large stones.	Not needed	Slow intake, large stones.	Large stones	Large stones.
[1]TyF:						
Truce part	Slight	Severe: large stones.	Not needed	Slow intake, complex slope.	Slope, large stones.	Slope, large stones.

See footnote at emd pf table.

TABLE 8.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments dikes and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Truce:						
Rock outcrop part.						
Venus:						
VeB	Severe: seepage.	Moderate: piping.	Not needed	Favorable	Favorable	Favorable.

[1] This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 9.—RECREATIONAL DEVELOPMENT

["Percs slowly" and other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe"]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Abilene:				
AbA	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
AbB	Moderate: percs slowly.	Slight	Moderate: percs slowly, slope.	Slight.
Bastrop:				
BaC	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.
BbA	Slight	Slight	Slight	Slight.
BbB	Slight	Slight	Moderate: slope.	Slight.
Bolar:				
BcB, BcC	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
BcD	Moderate: too clayey.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.
Bonti:				
BnB	Moderate: percs slowly.	Slight	Moderate: depth to rock, slope.	Slight.
Bosque:				
Bo	Severe: floods.	Moderate: floods.	Severe: floods.	Slight.
Brackett:				
[1]BrC:				
Brackett part	Moderate: percs slowly.	Slight	Severe: depth to rock.	Slight.
Bolar part	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
[1]BsE:				
Brackett part	Moderate: percs slowly.	Slight	Severe: depth to rock.	Slight.
Karnes part	Slight	Slight	Moderate: slope.	Slight.
[1]BTF	Moderate: percs slowly, slope.	Moderate: slope.	Severe: depth to rock.	Slight.
Chaney:				
ChC, ChC2	Moderate: percs slowly.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
ChD, CnD3	Moderate: percs slowly.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.
CmD	Severe: large stones.	Moderate: large stones, too sandy.	Severe: large stones.	Severe: large stones.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Cisco:				
CoC	Moderate: too sandy.	Moderate: too sandy.	Severe: soil blowing.	Moderate: too sandy.
Deleon:				
Dc, De	Severe: too clayey, floods.	Severe: too clayey, floods.	Severe: too clayey, floods.	Severe: too clayey.
Demona:				
DmC	Moderate: too sandy.	Moderate: too sandy.	Severe: too sandy, soil blowing.	Moderate: too sandy.
Denton:				
DnB, DnC	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
Energy:				
Ee	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
[1]Ef	Severe: floods.	Moderate: floods.	Severe: floods.	Slight.
Frio:				
Fr	Severe: floods.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
Hassee:				
HaA, HaB	Severe: wetness, percs slowly.	Moderate: wetness.	Severe: wetness, percs slowly.	Moderate: wetness.
Heaton:				
HdC	Moderate: too sandy.	Moderate: too sandy.	Severe: soil blowing, too sandy.	Moderate: too sandy.
Hensley:				
HeB	Moderate: percs slowly.	Slight	Severe: depth to rock.	Slight.
HnB	Moderate: large stones.	Slight	Severe: depth to rock.	Moderate: large stones.
Karnes:				
KaC	Slight	Slight	Moderate: slope.	Slight.
KaD	Slight	Slight	Severe: slope.	Slight.
Krum:				
KcA, KcB	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
Lamkin:				
La	Severe: floods.	Moderate: floods, too clayey.	Moderate: floods.	Moderate: too clayey.
[1]Lb	Severe: floods.	Moderate: floods, too clayey.	Severe: floods.	Moderate: too clayey.
Leeray:				
LcA, LcB	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Lewisville:				
LeB, LeC	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
Luckenbach:				
LuB	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Moderate: percs slowly, too clayey, slope.	Moderate: too clayey.
May:				
MfA	Slight	Slight	Slight	Slight.
MfB	Slight	Slight	Moderate: slope.	Slight.
Menard:				
MnB, MnC, [1]MsC2	Slight	Slight	Moderate: slope.	Slight.
MnD, MsD3	Slight	Slight	Severe: slope.	Slight.
Nimrod:				
NmC	Severe: too sandy, soil blowing.	Severe: too sandy, soil blowing.	Severe: too sandy, soil blowing.	Severe: too sandy.
Owens:				
OcC	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
OwG	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: slope, too clayey.	Severe: too clayey.
Patilo:				
[1]PaC:				
Patilo part	Severe: too sandy, soil blowing.	Severe: too sandy, soil blowing.	Severe: too sandy, soil blowing.	Severe: too sandy.
Nimrod part	Severe: too sandy, soil blowing.	Severe: too sandy, soil blowing.	Severe: too sandy, soil blowing.	Severe: too sandy.
Pedernales:				
PdC	Moderate: percs slowly.	Moderate: too sandy.	Moderate: percs slowly, too sandy.	Moderate: too sandy.
PeB, PeC, [1]PsC2	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
PeD; PsD3	Moderate: percs slowly.	Slight	Severe: slope.	Slight.
Purves:				
PuB, PuC	Severe: too clayey.	Severe: too clayey.	Severe: depth to rock, too clayey.	Severe: too clayey.
[1]PvG:				
Purves part	Severe: too clayey.	Severe: too clayey.	Severe: slope.	Severe: too clayey.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Purves:				
Tarrant part	Severe: large stones, slope.	Severe: large stones, too clayey.	Severe: depth to rock, slope.	Severe: large stones, too clayey.
[1]PXD:				
Purves part	Severe: too clayey.	Severe: too clayey.	Severe: large stones.	Severe: too clayey.
Bolar part	Moderate: large stones.	Moderate: large stones.	Severe: large stones.	Moderate: large stones.
Sunev:				
SuC	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey, slope.	Moderate: too clayey.
SuD	Moderate: too clayey.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.
Tarrant:				
[1]TAD	Severe: large stones, too clayey.	Severe: large stones, too clayey.	Severe: depth to rock, large stones.	Severe: large stones, too clayey.
[1]TAF:				
Tarrant part	Severe: large stones, slope.	Severe: large stones, too clayey.	Severe: depth to rock, slope.	Severe: large stones, too clayey.
Rock outcrop part.				
Thurber:				
TrA, TrB	Severe: percs slowly.	Moderate: too clayey.	Severe: percs slowly.	Moderate: too clayey.
Truce:				
TuB, TuC2	Moderate: percs slowly.	Slight	Moderate: percs slowly, slope.	Slight.
[1]TxD:				
Truce part	Moderate: large stones, percs slowly.	Slight	Severe: large stones.	Moderate: large stones.
Bonti part	Moderate: large stones.	Moderate: large stones.	Severe: large stones.	Moderate: large stones.
[1]TyF:				
Truce part	Moderate: large stones, percs slowly.	Moderate: slope, large stones.	Severe: slope, large stones.	Moderate: large stones.
Rock outcrop part.				
Venus:				
VeB	Slight	Slight	Moderate: slope.	Slight.

[1] This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 10.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates the soil was not rated]

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Abilene:									
AbA, AbB	Good	Good	Fair	Good	Poor	Very poor.	Good	Very poor.	Fair.
Bastrop:									
BaC	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
BbA, BbB	Good	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
Bolar:									
BcB	Good	Good	Fair	Fair	Poor	Very poor.	Good	Very poor.	Fair.
BcC, BcD	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Very poor.	Fair.
Bonti:									
BnB	Good	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
Bosque:									
Bo	Good	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
Brackett:									
[1]BrC:									
Brackett part	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Very poor.	Fair.
Bolar part	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Very poor.	Fair.
[1]BsE:									
Brackett part	Poor	Poor	Fair	Fair	Poor	Very poor.	Poor	Very poor.	Fair.
Karnes part	Fair	Fair	Good	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
[1]BTF	Very poor.	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Fair.
Chaney:									
ChC, ChC2, ChD	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
CnD3	Poor	Fair	Good	Good	Poor	Very poor.	Fair	Very poor.	Good.
CmD	Poor	Poor	Good	Good	Poor	Very poor.	Fair	Very poor.	Good.
Cisco:									
CoC	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
Deleon:									
Dc	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Poor	Fair.
De	Very poor.	Poor	Fair	Fair	Poor	Poor	Poor	Poor	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Demona:									
DmC	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
Denton:									
DnB	Good	Good	Fair	Fair	Poor	Very poor.	Good	Very poor.	Fair.
DnC	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Very poor.	Fair
Energy:									
Ee	Good	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
[1]Ef	Very poor.	Poor	Fair	Good	Poor	Very poor.	Poor	Very poor.	Fair.
Frio:									
Fr	Good	Good	Fair	Good	Poor	Very poor.	Good	Very poor.	Fair.
Hassee:									
HaA, HaB	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
Heaton:									
HdC	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
Hensley:									
HeB, HnB	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Very poor.	Fair.
Karnes:									
KaC, KaD	Fair	Fair	Good	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
Krum:									
KcA, KcB	Good	Good	Fair	Fair	Poor	Very poor.	Good	Very poor.	Fair.
Lamkin:									
La	Good	Good	Fair	Good	Poor	Very poor.	Good	Very poor.	Fair.
[1]Lb	Very poor.	Poor	Fair	Good	Poor	Very poor.	Poor	Very poor.	Fair.
Leeray:									
LcA, LcB	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Very poor.	Fair.
Lewisville:									
LeB, LeC	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Very poor.	Fair.
Luckenbach:									
LuB	Good	Good	Fair	Good	Poor	Very poor.	Good	Very poor.	Fair.
May:									
MfA, MfB	Good	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
Menard:									
MnB	Good	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
MnC, MnD	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.

See footnote at end of table.

TABLE 10.—WILDLIFE HABITAT POTENTIALS—Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for—		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Menard:									
[1]MsC2	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
[1]MsD3	Poor	Fair	Good	Good	Poor	Very poor.	Fair	Very poor.	Good.
Nimrod:									
NmC	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
Owens:									
OcC	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Fair	Very poor.	Poor.
OwG	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Poor	Very poor.	Poor.
Patilo:									
[1]PaC:									
Patilo part	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Very poor.	Fair.
Nimrod part	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
Pedernales:									
PdC	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
PeB	Good	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
PeC, PeD	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
[1]PsC2	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
[1]PsD3	Poor	Fair	Good	Good	Poor	Very poor.	Fair	Very poor.	Good.
Purves:									
PuB, PuC	Fair	Good	Poor	Fair	Poor	Very poor.	Fair	Very poor.	Poor.
[1]PvG:									
Purves part	Very poor.	Very poor.	Poor	Good	Very poor.	Very poor.	Poor	Very poor.	Fair.
Tarrant part	Very poor.	Very poor.	Fair	Fair	Very poor.	Very poor.	Poor	Very poor.	Fair.
[1]PXD:									
Purves part	Poor	Poor	Poor	Good	Poor	Very poor.	Poor	Very poor.	Fair.
Bolar part	Poor	Poor	Fair	Fair	Poor	Very poor.	Poor	Very poor.	Fair.
Sunev:									
SuC, SuD	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
Tarrant:									
[1]TAD	Very poor.	Very poor.	Fair	Fair	Very poor.	Very poor.	Poor	Very poor.	Fair.
[1]TAF:									
Tarrant part.	Very poor.	Very poor.	Fair	Fair	Very poor.	Very poor.	Poor	Very poor.	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Tarrant:									
[1]TAF:									
Rock outcrop part.									
Thurber:									
TrA, TrB	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Poor	Fair.
Truce:									
TuB	Good	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
TuC2	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
[1]TxD:									
Truce part	Poor	Poor	Good	Good	Poor	Very poor.	Fair	Very poor.	Good.
Bonti part	Poor	Poor	Good	Good	Poor	Very poor.	Fair	Very poor.	Good.
[1]TyF:									
Truce part	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Poor	Very poor.	Good.
Rock outcrop part.									
Venus:									
VeB	Good	Good	Good	Fair	Poor	Very poor.	Good	Very poor.	Fair.

---

[1] This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Abilene:											
AbA, AbB	0-6	Loam	CL	A-4, A-6	0	95-100	95-100	90-100	60-96	25-35	8-16
	6-48	Clay loam, silty clay loam, clay.	CL, CH	A-7	0	95-100	95-100	90-100	75-95	4-58	22-40
	48-62	Clay loam, clay, silty clay loam, sandy clay loam.	CL	A-6, A-7	0	90-100	88-100	80-98	60-95	35-50	19-32
Bastrop:											
BaC	0-14	Loamy fine sand	SM, SM-SC	A-2-4, A-4	0	95-100	80-100	75-95	20-50	<20	NP-4
	14-75	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	95-100	80-100	80-100	40-70	26-40	11-22
BbA, BbB	0-8	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4	0	95-100	80-100	80-100	36-70	18-25	2-7
	8-70	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	95-100	80-100	80-100	40-70	26-40	11-22
Bolar:											
BcB, BcC, BcD	0-18	Clay loam	CL, SC	A-6, A-7, A-4	0-5	75-100	75-100	70-98	40-80	25-42	9-25
	18-36	Clay loam, loam, silty clay loam.	CL, SC	A-6, A-7	0-10	75-95	75-95	70-90	40-75	25-42	11-25
	36-37	Weathered bedrock.									
Bonti:											
BnB	0-8	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0-2	90-100	90-100	70-100	25-70	18-30	2-7
	8-34	Clay, clay loam, sandy clay.	CL	A-6, A-7	0-4	80-100	80-100	70-100	51-75	30-45	18-25
	34-36	Weathered bedrock.									
Bosque:											
Bo	0-32	Loam	CL, CL-ML	A-4, A-6	0	100	95-100	80-100	55-95	24-40	7-22
	32-52	Loam, clay loam	CL	A-4, A-6, A-7-6	0	100	95-100	95-100	55-80	26-45	10-25
	52-60	Loam, clay loam, clay.	CL, CL-ML	A-4, A-6, A-7-6	0	98-100	95-100	80-100	55-95	24-45	7-25
Brackett:											
[1]BrC:											
Brackett part	0-18	Gravelly clay loam.	CL, SC	A-6, A-4	0-20	70-100	60-100	55-95	40-85	28-40	10-20
	18-36	Weathered bedrock.									
Bolar part	0-18	Clay loam	CL, SC	A-6, A-7, A-4	0-5	75-100	75-100	70-98	40-80	25-42	9-25
	18-36	Clay loam, loam, silty clay loam.	CL, SC	A-6, A-7	0-10	75-95	75-95	70-90	40-75	25-42	11-25
	36-37	Weathered bedrock.									

See footnote at end of table.

TABLE 11.— ENGINEERING PROPERTIES AND CLASSIFICATIONS—Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Brackett:											
[1]BsE:											
Brackett part	0-16	Loam	CL, SC	A-6, A-4	0-20	70-100	60-100	55-95	40-85	28-40	10-20
	16-36	Weathered bedrock.									
Karnes part	0-40	Loam	SC, CL, CL-ML, SM-SC	A-4, A-6, A-2-4, A-2-6	0-5	85-100	75-100	50-100	30-65	20-35	4-15
	40-62	Loam, fine sandy loam, clay loam.	SC, CL, CL-ML, SM-SC	A-4, A-6, A-2-4, A-2-6	0-5	85-100	75-100	45-100	25-65	20-35	4-15
[1]BTF	0-16	Gravelly loam	CL, SC	A-6, A-4	0-20	70-100	60-100	55-95	40-85	28-40	10-20
	16-30	Weathered bedrock.									
Chaney:											
ChC, ChC2, ChD, CnD3	0-8	Loamy sand	SM, SM-SC, SP-SM	A-2-4, A-4, A-3	0	80-100	80-100	65-98	7-45	<25	NP-4
	8-36	Clay, sandy clay	CL, CH	A-7-6	0	90-100	90-100	90-100	51-85	42-60	24-42
	36-48	Sandy clay, clay, sandy clay loam.	CL, CH, SC	A-6, A-7-6, A-2-6	0	90-100	90-100	80-100	30-70	25-55	11-40
	48-62	Clay, sandy clay loam, sandy clay.	CL, CH, SC, SM-SC	A-6, A-7-6, A-2	0	90-100	90-100	80-100	25-85	25-60	6-40
CmD	0-12	Stony loamy sand	SM, SM-SC, SP-SM	A-2-4, A-4, A-3	5-15	80-100	80-100	65-98	7-45	<25	NP-4
	12-36	Clay, sandy clay	CL, CH	A-7	0-15	90-100	90-100	90-100	51-85	42-60	24-42
	36-44	Sandy clay, clay, sandy clay loam.	CL, CH, SC	A-6, A-7-6, A-2-6	0	90-100	90-100	80-100	30-70	25-55	11-40
	44-62	Clay, sandy clay loam, sandy clay.	CL, CH, SC, SM-SC	A-2-4, A-2-6, A-6, A-7	0	90-100	90-100	80-100	25-85	25-60	6-40
Cisco:											
CoC	0-10	Loamy fine sand	SM, SM-SC	A-4, A-2-4	0	95-100	95-100	80-100	15-45	<25	NP-4
	10-56	Sandy clay loam, clay loam.	SC, CL	A-6	0	95-100	95-100	85-100	40-60	25-40	11-25
	56-70	Sandy clay loam, fine sandy loam.	SC, CL	A-4, A-6	0	95-100	95-100	85-95	40-60	20-35	8-20
Deleon:											
Dc, De	0-36	Clay	CH, CL	A-7	0	95-100	95-100	95-100	85-100	41-60	25-35
	36-62	Clay, silty clay, silty clay loam.	CH, CL	A-7, A-6	0	95-100	95-100	90-100	85-100	35-60	20-35
Demona:											
DmC	0-36	Loamy sand	SM, SP-SM, SM-SC	A-2-4, A-4, A-3	0	80-100	75-100	60-98	7-45	<25	NP-5
	36-60	Sandy clay, clay	CH, CL	A-7-6	0	80-100	80-100	80-100	50-85	42-60	24-40
	60-74	Sandy clay, clay, sandy clay loam.	CL, CH, SC	A-2-6, A-7-6, A-6	0	80-100	80-100	80-100	25-85	25-60	11-40

See footnote at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Denton:											
DnB, DnC	0-24	Silty clay	CH, MH	A-7	0-10	80-100	80-100	80-100	75-95	51-70	26-45
	24-36	Silty clay, clay, silty clay loam.	CH, CL, MH	A-7	0-20	80-100	80-100	80-100	70-95	41-60	21-40
	36-38	Weathered bedrock.									
Energy:											
Ee, [1]Ef	0-8	Fine sandy loam	CL, ML, SM, SC	A-4, A-6	0	95-100	95-100	80-100	40-75	<30	NP-16
	8-38	Stratified clay loam to fine sandy loam.	CL, SC	A-4, A-6	0	95-100	95-100	80-100	40-95	20-40	8-25
	38-44	Stratified loamy sand to fine sandy loam.	SM, SM-SC, CL-ML, ML	A-2-4, A-4	0	95-100	95-100	60-85	13-55	<25	NP-7
	44-62	Stratified clay loam to fine sandy loam.	CL, SC	A-4, A-6	0	95-100	95-100	80-100	40-95	20-40	8-25
Frio:											
Fr	0-50	Clay loam, silty clay.	CL, CH	A-6, A-7	0-2	80-100	80-100	70-100	60-95	35-52	20-34
	50-62	Silty clay, clay loam, gravelly clay loam.	CL, CH	A-6, A-7	0-2	65-100	65-100	60-100	55-95	35-52	20-34
Hassee:											
HaA, HaB	0-12	Loam	CL	A-4, A-6	0	95-100	95-100	80-100	50-80	20-35	8-16
	12-42	Clay	CH, CL	A-7-6	0	95-100	95-100	95-100	75-95	41-60	24-40
	42-60	Clay, clay loam	CH, CL	A-7-6, A-6	0	95-100	95-100	90-100	70-95	35-52	20-35
Heaton:											
HdC	0-34	Loamy fine sand	SM	A-2-4	0	95-100	95-100	70-90	15-30	<25	NP-3
	34-68	Sandy clay loam	SC, SM-SC	A-2-4, A-4, A-6, A-2-6	0	98-100	95-100	75-90	25-45	20-35	4-15
	68-80	Sandy clay loam, fine sandy loam.	SC, SM-SC	A-2-4, A-4, A-6, A-2-6	0	98-100	95-100	75-90	25-45	20-30	4-15
Hensley:											
HeB	0-5	Loam	CL, CL-ML	A-6, A-4	0-2	80-100	75-100	70-100	60-85	20-40	5-20
	5-18	Clay, clay loam	CL, CH	A-6, A-7	0-10	80-100	75-100	70-100	60-95	35-55	18-35
	18-19	Unweathered bedrock.									
HnB	0-5	Stony loam	CL, SC, GC, GM-GC	A-6, A-4	8-25	65-95	60-95	55-95	36-80	20-40	5-20
	5-18	Clay, clay loam	CL, CH	A-6, A-7	0-10	80-100	75-100	70-100	60-95	35-55	18-35
	18-19	Unweathered bedrock.									
Karnes:											
KaC, KaD	0-48	Loam, sandy loam, fine sandy loam.	SC, CL, CL-ML, SM-SC	A-4, A-6, A-2-4, A-2-6	0-5	85-100	75-100	50-100	30-65	20-35	4-15
	48-62	Loam, fine sandy loam, clay loam.	SC, CL, CL-ML, SM-SC	A-4, A-6, A-2-4, A-2-6	0-5	85-100	75-100	45-100	25-65	20-35	4-15

See footnote at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Krum:											
KcA, KcB	0-36	Silty clay	CH	A-7-6	0	95-100	85-100	85-100	85-95	51-65	25-45
	36-56	Silty clay, clay	CH	A-7-6	0	95-100	85-100	80-100	65-95	51-74	28-50
	56-62	Silty clay loam, silty clay, clay.	CH, CL	A-7-6	0	85-100	75-100	70-95	65-95	48-60	28-38
Lamkin:											
La, [1]Lb	0-16	Clay loam	CL	A-6	0	100	99-100	90-100	70-90	30-40	15-22
	16-62	Silt loam, very fine sandy loam, silty clay loam.	CL	A-6, A-7	0	100	99-100	90-100	60-99	30-45	11-25
Leeray:											
LcA, LcB	0-54	Clay	CH	A-7-6	0-5	95-100	95-100	85-100	75-95	51-70	30-45
	54-65	Clay, silty clay	CH, CL	A-7-6	0-5	95-100	95-100	85-100	70-95	41-60	25-40
Lewisville:											
LeB, LeC	0-18	Clay loam	CL, CH	A-7	0	100	99-100	82-99	80-95	41-59	20-36
	18-46	Silty clay loam, clay loam.	CL, CH	A-7	0	99-100	98-100	73-99	72-95	48-60	25-36
	46-62	Silty clay, clay loam.	CL, CH, SC	A-6, A-7	0	83-100	65-99	56-98	41-95	30-55	12-34
Luckenbach:											
LuB	0-8	Clay loam	CL	A-6	0-3	95-100	95-100	75-95	55-65	29-40	14-25
	8-36	Clay loam, clay	CL, CH	A-6, A-7	0-3	90-100	80-100	80-100	60-85	40-55	22-35
	36-62	Clay loam, clay	CL, SC	A-6, A-7	0-5	70-100	60-95	45-95	36-80	35-45	20-30
May:											
MfA, MfB	0-12	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4	0	95-100	95-100	80-100	40-60	<25	NP-7
	12-37	Sandy clay loam, clay loam.	SC, CL	A-6	0	95-100	95-100	80-100	40-75	25-40	12-25
	37-62	Sandy clay loam, fine sandy loam, loam.	SC, CL	A-4, A-6	0	95-100	95-100	75-100	40-75	20-40	8-25
Menard:											
MnB, MnC, MnD, [1]MsC2, [1]MsD3	0-10	Fine sandy loam	SM, SM-SC, CL-ML, ML	A-2-4, A-4	0	95-100	95-100	75-100	30-60	<25	NP-7
	10-34	Sandy clay loam, clay loam.	SC, CL	A-6, A-4	0	95-100	95-100	80-100	36-70	26-40	10-22
	34-60	Sandy clay loam, clay loam, sandy loam.	SC, CL	A-4, A-6	0-5	80-100	75-100	65-99	40-60	20-35	8-20
Nimrod:											
NmC	0-26	Fine sand	SP-SM, SM, SM-SC	A-2-4, A-3	0	95-100	95-100	90-100	8-28	<25	NP-4
	26-72	Sandy clay loam	SC, CL	A-6, A-2-6	0	95-100	95-100	90-100	25-55	20-35	11-20
	72-80	Sandy loam, sandy clay loam, loamy fine sand.	SC, CL, SM-SC, CL-ML	A-4, A-6, A-2-4, A-2-6	0	95-100	95-100	90-100	15-55	20-30	4-16
Owens:											
OcC	0-8	Clay	CL, CH	A-7-6	0-5	95-100	95-100	85-100	75-95	45-60	22-32
	8-18	Clay, clay loam	CL, CH	A-7-6	0-5	95-100	90-100	85-100	75-95	45-60	22-32
	18-42	Shaly clay	CL, CH	A-6, A-7-6	0-5	90-100	85-100	80-100	55-95	40-55	25-35

See footnote at end of table.

TABLE 11.—ENGINEERING PROPERTIES AND CLASSIFICATIONS—Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Owens: OwG	0-6	Stony clay	CL, CH	A-7-6	5-20	90-100	80-100	70-100	60-95	45-60	22-32
	6-16	Clay, clay loam	CL, CH	A-7-6	0-5	95-100	90-100	85-100	75-95	45-60	22-32
	16-30	Shaly clay	CL, CH	A-6, A-7-6	0-5	90-100	85-100	80-100	55-95	40-55	25-35
Patilo: [1]PaC: Patilo part	0-44	Fine sand	SM, SP-SM, SM-SC	A-2-4, A-3	0	100	95-100	85-100	8-28	<25	NP-5
	44-70	Sandy clay loam, fine sandy loam.	SC	A-2, A-4, A-6	0	90-100	90-100	90-100	25-50	22-36	8-20
Nimrod part	0-36	Fine sand	SP-SM, SM, SM-SC	A-2-4, A-3	0	95-100	95-100	90-100	8-28	<25	NP-4
	36-48	Sandy clay loam	SC, CL	A-6, A-2-6	0	95-100	95-100	90-100	25-55	20-35	11-20
	48-64	Sandy loam, sandy clay loam, loamy fine sand.	SC, CL, SM-SC, CL-ML	A-4, A-6, A-2-4, A-2-6	0	95-100	95-100	90-100	15-55	20-30	4-16
Pedernales: PdC	0-8	Loamy fine sand	SM	A-2-4	0	95-100	90-100	75-95	15-33	<25	NP-3
	8-36	Sandy clay, clay	CH, CL, SC	A-7, A-6	0	90-100	90-100	85-100	45-75	38-60	20-36
	36-60	Sandy clay loam, clay loam, sandy clay.	SC, CL, CH	A-6, A-7	0-5	90-100	90-100	80-100	36-75	32-55	13-30
PeB, PeC, PeD, [1]PsC2, [1]PsD3	0-4	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4, A-2-4	0	95-100	90-100	75-100	33-55	<25	NP-7
	4-42	Sandy clay, clay	CH, CL, SC	A-7, A-6	0	90-100	90-100	85-100	45-75	38-60	20-36
	42-60	Sandy clay loam, clay loam, sandy clay.	SC, CL, CH	A-6, A-7	0-5	90-100	90-100	80-100	36-75	32-55	13-30
Purves: PuB, PuC	0-16	Clay	CH	A-7-6	0-5	90-100	80-100	80-95	70-95	51-65	30-40
	16-17	Unweathered bedrock.									
[1]PvG: Purves part	0-6	Stony clay	CH, GC, SC	A-7-6	5-25	55-95	55-95	45-95	36-90	51-65	30-40
	6-16	Gravelly clay, very gravelly clay, stony clay, clay.	GC, CH, SC	A-7-6	5-35	55-95	55-95	45-90	36-65	51-65	30-40
	16-17	Unweathered bedrock.									
Tarrant part	0-16	Cobbly clay	CH, GC	A-7-6	33-77	55-100	51-100	51-95	45-95	55-76	31-49
	16-17	Indurated, unweathered bedrock.									

See footnote at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Purves:											
[1]PXD:											
Purves part	0-6	Stony clay	CH, GC, SC	A-7-6	5-25	55-95	55-95	45-95	36-90	51-65	30-40
	6-18	Gravelly clay, very gravelly clay, stony clay, clay.	GC, CH, SC	A-7-6	5-35	55-95	55-95	45-90	36-65	51-65	30-40
	18-19	Unweathered bedrock.									
Bolar part	0-18	Stony clay loam	CL, SC	A-6, A-7, A-4	8-20	75-90	75-90	70-85	36-65	25-42	9-25
	18-36	Clay loam, loam, silty clay loam.	CL, SC	A-6, A-7	0-10	75-95	75-95	70-90	40-75	25-42	11-25
	36-37	Weathered bedrock.									
Sunev:											
SuC, SuD	0-16	Clay loam	CL, SC	A-4, A-6	0	90-100	80-100	80-100	45-60	25-40	8-18
	16-44	Loam, clay loam, silty clay loam.	CL	A-4, A-6	0	90-100	80-100	80-100	51-65	28-40	8-18
	44-60	Loam, clay loam, silty clay loam.	CL	A-4, A-6	0	90-100	75-100	75-100	51-61	25-40	8-18
Tarrant:											
[1]TAD	0-16	Cobbly clay	CH, GC	A-7-6	33-77	55-100	51-100	51-95	45-95	55-76	31-49
	16-17	Indurated, unweathered bedrock.									
[1]TAF:											
Tarrant part.	0-10	Cobbly clay	CH, GC	A-7-6	33-77	55-100	51-100	51-95	45-95	55-76	31-49
	10-13	Indurated unweathered bedrock.									
Rock outcrop part.											
Thurber:											
TrA, TrB	0-8	Clay loam	CL	A-4, A-6	0	95-100	95-100	90-100	60-90	25-35	8-20
	8-50	Clay, clay loam	CL, CH	A-7-6	0	95-100	95-100	90-100	70-95	41-65	25-45
	50-64	Clay, clay loam	CL	A-6, A-7-6	0	95-100	85-100	75-100	50-85	35-50	20-35
Truce:											
TuB, TuC2	0-5	Fine sandy loam	CL-ML, CL, SM-SC, SC	A-4	0	75-100	75-100	70-100	40-75	18-30	5-10
	5-48	Clay, sandy clay, clay loam.	CL	A-6, A-7	0	80-100	80-100	80-100	50-80	30-45	20-30
	48-60	Shaly weathered bedrock.									
[1]TxD:											
Truce part	0-6	Stony fine sandy loam.	SC, CL-ML, SC	A-4	5-20	70-90	70-85	65-85	36-60	18-30	5-10
	6-44	Clay, sandy clay, clay loam.	CL	A-6, A-7	0-10	80-100	80-100	80-100	50-80	30-45	20-30
	44-62	Shaly weathered bedrock.									

See footnote at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Truce:											
[1]TxD:											
Bonti part	0-5	Stony fine sandy loam.	SM, SM-SC, ML, CL-ML	A-4, A-2-4	8-25	75-90	75-90	55-90	30-55	18-30	2-7
	5-28	Clay, clay loam, sandy clay.	CL	A-6, A-7	0-4	80-100	80-100	70-100	51-75	30-45	18-25
	28-29	Weathered bedrock.									
[1]TyF:											
Truce part	0-6	Stony fine sandy loam.	SC, CL-ML, SC	A-4	5-20	70-90	70-85	65-85	36-60	18-30	5-10
	6-42	Clay, sandy clay, clay loam.	CL	A-6, A-7	0-10	80-100	80-100	80-100	50-80	30-45	20-30
	42-64	Shaly weathered bedrock.									
Rock outcrop part.											
Venus:											
VeB	0-12	Loam	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	50-80	20-40	5-20
	12-44	Loam, clay loam, sandy clay loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	50-80	20-40	5-20
	44-62	Fine sandy loam, loam, sandy clay loam, gravelly loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	80-100	70-100	65-100	40-80	20-40	5-20

---

[1] This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 12.—PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[Dashes indicate data were not available. The symbol < means less than. The erosion tolerance factor (T) is for the entire profile. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
						Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH						
Abilene:										
AbA, AbB	0-6	0.6-2.0	0.15-0.20	6.6-8.4	Moderate	High	Low	0.37	5	6
	6-48	0.2-0.6	0.14-0.18	6.6-8.4	Moderate	High	Low	0.28		
	48-62	0.2-0.6	0.12-0.15	7.9-8.4	Moderate	High	Low	0.32		
Bastrop:										
BaC	0-14	2.0-6.0	0.07-0.11	5.6-7.3	Very low	Low	Low	0.20	5	2
	14-75	0.6-2.0	0.15-0.19	6.1-8.4	Low	Moderate	Low	0.32		
BbA, BbB	0-8	2.0-6.0	0.11-0.17	5.6-7.3	Low	Low	Low	0.24	5	3
	8-70	0.6-2.0	0.15-0.19	6.1-8.4	Low	Moderate	Low	0.32		
Bolar:										
BcB, BcC, BcD	0-18	0.6-2.0	0.11-0.20	7.9-8.4	Moderate	High	Low	0.32	2	4L
	18-36	0.6-2.0	0.11-0.20	7.9-8.4	Moderate	High	Low	0.17		
	36-37									
Bonti:										
BnB	0-8	0.6-2.0	0.11-0.15	5.6-7.3	Low	Low	Moderate	0.37	2	3
	8-34	0.2-0.6	0.15-0.20	5.1-6.0	Moderate	High	Moderate	0.28		
	34-36									
Bosque:										
Bo	0-32	0.6-2.0	0.15-0.20	7.4-8.4	Low	High	Low	0.28	5	4L
	32-52	0.6-2.0	0.15-0.20	7.4-8.4	Low	High	Low	0.28		
	52-60	0.6-2.0	0.11-0.18	7.9-8.4	Low	High	Moderate	0.28		
Brackett:										
[1]BrC:										
Brackett part	0-18	0.2-0.6	0.10-0.20	7.9-8.4	Low	High	Low	0.32	2	8
	18-36									
Bolar part	0-18	0.6-2.0	0.11-0.20	7.9-8.4	Moderate	High	Low	0.32	2	4L
	18-36	0.6-2.0	0.11-0.20	7.9-8.4	Moderate	High	Low	0.17		
	36-37									
[1]BsE:										
Brackett part	0-16	0.2-0.6	0.10-0.20	7.9-8.4	Low	High	Low	0.32	2	4L
	16-36									
Karnes part	0-40	2.0-6.0	0.10-0.15	7.9-8.4	Low	Moderate	Low	0.28	5	4L
	40-62	2.0-6.0	0.08-0.15	7.9-8.4	Low	Moderate	Low	0.28		
[1]BTF	0-16	0.2-0.6	0.10-0.20	7.9-8.4	Low	High	Low	0.32	2	8
	16-30									
Chaney:										
ChC, ChC2, ChD, CnD3	0-8	2.0-6.0	0.05-0.10	5.6-7.3	Very low	Low	Low	0.20	5	2
	8-36	0.06-0.2	0.15-0.18	5.6-6.5	Moderate	High	Moderate	0.28		
	36-48	0.06-0.2	0.15-0.18	5.6-6.5	Moderate	High	Moderate	0.28		
	48-62	0.06-0.2	0.15-0.18	5.6-7.8	Moderate	High	Moderate	0.28		
CmD	0-12	2.0-6.0	0.04-0.08	5.6-7.3	Very low	Low	Low	0.20	5	2
	12-36	0.06-0.2	0.11-0.18	5.6-6.5	Moderate	High	Moderate	0.28		
	36-44	0.06-0.2	0.15-0.18	5.6-6.5	Moderate	High	Moderate	0.28		
	44-62	0.06-0.2	0.15-0.18	5.6-7.8	Moderate	High	Moderate	0.28		
Cisco:										
CoC	0-10	2.0-6.0	0.07-0.11	6.1-7.3	Very low	Low	Low	0.20	5	2
	10-56	0.6-2.0	0.15-0.19	6.1-7.8	Moderate	Moderate	Low	0.32		
	56-70	2.0-6.0	0.11-0.17	7.4-8.4	Low	High	Low	0.32		
Deleon:										
Dc, De	0-36	0.06-0.2	0.14-0.18	6.6-8.4	High	High	Low	0.32	5	4
	36-62	0.06-0.2	0.14-0.22	7.9-8.4	High	High	Low	0.32		

See footnote at end of table.

TABLE 12.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH						
Demona:										
DmC	0-36	2.0-6.0	0.05-0.10	5.6-7.8	Very low	Low	Moderate	0.17	5	2
	36-60	0.2-0.6	0.15-0.18	5.1-6.5	Moderate	High	Moderate	0.24		
	60-74	0.2-0.6	0.14-0.18	5.1-6.5	Moderate	High	Moderate	0.24		
Denton:										
DnB, DnC	0-24	0.06-0.2	0.15-0.20	7.9-8.4	High	High	Low	0.32	2	4
	24-36	0.06-0.2	0.15-0.20	7.9-8.4	High	High	Low	0.32		
	36-38									
Energy:										
Ee, [1]Ef	0-8	0.6-2.0	0.11-0.15	7.9-8.4	Low	Moderate	Low	0.28	5	3
	8-38	0.6-2.0	0.11-0.20	7.9-8.4	Low	Moderate	Low	0.28		
	38-44	2.0-6.0	0.06-0.15	7.9-8.4	Low	Moderate	Low	0.20		
	44-62	0.6-2.0	0.11-0.20	7.9-8.4	Low	Moderate	Low	0.28		
Frio:										
Fr	0-50	0.2-0.6	0.15-0.22	7.9-8.4	Moderate	High	Low	0.32	5	4
	50-62	0.2-0.6	0.11-0.22	7.9-8.4	Moderate	High	Low	0.32		
Hassee:										
HaA, HaB	0-12	0.6-2.0	0.11-0.20	6.1-7.3	Low	High	Low	0.43	5	5
	12-42	<0.06	0.12-0.18	6.1-8.4	High	High	Low	0.32		
	42-60	<0.06	0.12-0.20	6.6-8.4	High	High	Low	0.32		
Heaton:										
HdC	0-34	2.0-6.0	0.05-0.09	5.6-7.3	Very low	Low	Low	0.17	5	2
	34-68	0.6-2.0	0.14-0.16	5.6-7.3	Low	Moderate	Low	0.24		
	68-80	0.6-2.0	0.10-0.14	5.6-7.3	Low	Moderate	Low	0.24		
Hensley:										
HeB	0-5	0.2-0.6	0.12-0.20	6.1-7.8	Low	High	Low	0.37	1	6
	5-18	0.06-0.2	0.10-0.20	6.6-8.4	Moderate	High	Low	0.32		
HnB	0-5	0.2-0.6	0.10-0.18	6.1-7.8	Low	High	Low	0.37	1	8
	5-18	0.06-0.2	0.10-0.20	6.6-8.4	Moderate	High	Low	0.32		
Karnes:										
KaC, KaD	0-48	2.0-6.0	0.10-0.15	7.9-8.4	Low	Moderate	Low	0.28	5	4L
	48-62	2.0-6.0	0.08-0.15	7.9-8.4	Low	Moderate	Low	0.28		
Krum:										
KcA, KcB	0-36	0.2-0.6	0.15-0.20	7.4-8.4	High	High	Low	0.32	5	4
	36-56	0.2-0.6	0.14-0.20	7.9-8.4	High	High	Low	0.32		
	56-62	0.2-0.6	0.14-0.20	7.9-8.4	High	High	Low	0.32		
Lamkin:										
La, [1]Lb	0-16	0.6-2.0	0.15-0.19	7.9-8.4	Moderate	Moderate	Low	0.37	5	6
	16-62	0.6-2.0	0.14-0.22	7.9-8.4	Moderate	Moderate	Low	0.43		
Leeray:										
LcA, LcB	0-54	<0.06	0.12-0.18	7.9-8.4	Very high	High	Low	0.32	5	4
	54-65	<0.06	0.10-0.15	7.9-8.4	Very high	High	Low	0.32		
Lewisville:										
LeB, LeC	0-18	0.6-2.0	0.16-0.20	7.9-8.4	High	High	Low	0.32	5	6
	18-46	0.6-2.0	0.14-0.18	7.9-8.4	High	High	Low	0.37		
	46-62	0.6-2.0	0.14-0.18	7.9-8.4	High	High	Low	0.37		
Luckenbach:										
LuB	0-8	0.6-2.0	0.15-0.18	6.1-7.8	Low	Moderate	Low	0.24	5	6
	8-36	0.2-0.6	0.13-0.18	7.4-8.4	Moderate	Moderate	Low	0.20		
	36-62	0.2-0.6	0.10-0.15	7.9-8.4	Moderate	Moderate	Low	0.15		
May:										
MfA, MfB	0-12	2.0-6.0	0.11-0.15	6.1-7.8	Low	Low	Low	0.37	5	3
	12-37	0.6-2.0	0.12-0.20	6.6-7.8	Moderate	Moderate	Low	0.37		
	37-62	0.6-2.0	0.11-0.20	7.4-8.4	Moderate	High	Low	0.37		

See footnote at end of table.

TABLE 12.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH						
Menard:										
MnB, MnC, MnD, [1]MsC2, [1]MsD3	0-10	2.0-6.0	0.11-0.17	6.6-7.8	Low	Low	Low	0.43	5	3
	10-34	0.6-2.0	0.15-0.19	6.1-7.8	Low	Moderate	Low	0.49		
	34-60	2.0-6.0	0.11-0.17	7.9-8.4	Low	High	Low	0.49		
Nimrod:										
NmC	0-26	6.0-20	0.05-0.10	5.6-7.3	Very low	Low	Low	0.20	5	1
	26-72	0.2-0.6	0.12-0.17	5.1-6.0	Low	High	Moderate	0.32		
	72-80	0.2-0.6	0.06-0.17	5.1-6.5	Low	High	Moderate	0.32		
Owens:										
OcC	0-8	<0.06	0.13-0.17	7.9-8.4	High	High	Low	0.37	1	4
	8-18	<0.06	0.13-0.17	7.9-8.4	High	High	Low	0.37		
	18-42	<0.06	0.03-0.08	7.9-8.4	High	High	Low	0.37		
OwG	0-6	<0.06	0.10-0.17	7.9-8.4	High	High	Low	0.37	1	8
	6-16	<0.06	0.13-0.17	7.9-8.4	High	High	Low	0.37		
	16-30	<0.06	0.03-0.08	7.9-8.4	High	High	Low	0.37		
Patilo:										
[1]PaC:										
Patilo part	0-44	6.0-20	0.05-0.08	5.6-7.3	Very low	Low	Low	0.17	5	1
	44-70	0.2-0.6	0.14-0.18	5.1-6.5	Low	High	Moderate	0.24		
Nimrod part	0-36	6.0-20	0.05-0.10	5.6-7.3	Very low	Low	Low	0.20	5	1
	36-48	0.2-0.6	0.12-0.17	5.1-6.0	Low	High	Moderate	0.32		
	48-64	0.2-0.6	0.06-0.17	5.1-6.5	Low	High	Moderate	0.32		
Pedernales:										
PdC	0-8	2.0-6.0	0.07-0.11	6.1-7.8	Low	Low	Low	0.24	5	2
	8-36	0.2-0.6	0.15-0.20	6.1-7.8	Moderate	High	Low	0.24		
	36-60	0.2-0.6	0.15-0.20	7.9-8.4	Moderate	Moderate	Low	0.15		
PeB, PeC, PeD, [1]PsC2, [1]PsD3	0-4	0.6-2.0	0.12-0.17	6.1-7.8	Low	Low	Low	0.37	5	3
	4-42	0.2-0.6	0.15-0.20	6.1-7.8	Moderate	High	Low	0.24		
	42-60	0.2-0.6	0.15-0.20	7.9-8.4	Moderate	Moderate	Low	0.15		
Purves:										
PuB, PuC	0-16	0.2-0.6	0.12-0.18	7.9-8.4	High	High	Low	0.32	1	4
	16-17									
[1]PvG:										
Purves part	0-6	0.2-0.6	0.08-0.15	7.9-8.4	High	High	Low	0.24	1	8
	6-16	0.2-0.6	0.08-0.15	7.9-8.4	High	High	Low	0.24		
	16-17									
Tarrant part	0-16	0.2-0.6	0.10-0.17	7.9-8.4	Low	High	Low	0.32	1	8
	16-17									
[1]PXD:										
Purves part	0-6	0.2-0.6	0.08-0.15	7.9-8.4	High	High	Low	0.24	1	8
	6-18	0.2-0.6	0.08-0.15	7.9-8.4	High	High	Low	0.24		
	18-19									
Bolar part	0-18	0.6-2.0	0.10-0.18	7.9-8.4	Moderate	High	Low	0.32	2	8
	18-36	0.6-2.0	0.11-0.20	7.9-8.4	Moderate	High	Low	0.17		
	36-37									
Sunev:										
SuC, SuD	0-16	0.6-2.0	0.11-0.16	7.9-8.4	Low	Moderate	Low	0.28	5	4L
	16-44	0.6-2.0	0.11-0.16	7.9-8.4	Low	Moderate	Low	0.28		
	44-60	0.6-2.0	0.11-0.16	7.9-8.4	Low	Moderate	Low	0.28		
Tarrant:										
[1]TAD	0-16	0.2-0.6	0.10-0.17	7.9-8.4	Low	High	Low	0.32	1	8
	16-17									

See footnote at end of table.

TABLE 12.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
						Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH						
Tarrant:										
[1]TAF:										
Tarrant part.	0-10	0.2-0.6	0.10-0.17	7.9-8.4	Low	High	Low	0.32	1	8
	10-13									
Rock outcrop part.										
Thurber:										
TrA, TrB	0-8	0.2-0.6	0.15-0.22	6.1-7.8	Moderate	High	Low	0.43	5	6
	8-50	<0.06	0.12-0.18	6.6-8.4	High	High	Low	0.32		
	50-64	<0.06	0.12-0.18	7.4-8.4	High	High	Low	0.32		
Truce:										
TuB, TuC2	0-5	0.6-2.0	0.11-0.15	5.6-7.3	Low	Low	Low	0.32	3	3
	5-48	0.06-0.2	0.12-0.18	6.1-8.4	Moderate	High	Low	0.32		
	48-60									
[1]TxD:										
Truce part	0-6	0.6-2.0	0.08-0.12	5.6-7.3	Low	Low	Low	0.24	3	8
	6-44	0.06-0.2	0.12-0.18	6.1-8.4	Moderate	High	Low	0.32		
	44-62									
Bonti part	0-5	0.6-2.0	0.08-0.12	5.6-7.3	Low	Low	Moderate	0.32	2	8
	5-28	0.2-0.6	0.15-0.20	5.1-6.0	Moderate	High	Moderate	0.28		
	28-29									
[1]TyF:										
Truce part	0-6	0.6-2.0	0.08-0.12	5.6-7.3	Low	Low	Low	0.24	3	8
	6-42	0.06-0.2	0.12-0.18	6.1-8.4	Moderate	High	Low	0.32		
	42-64									
Rock outcrop part.										
Venus:										
VeB	0-12	0.6-2.0	0.15-0.20	7.9-8.4	Low	High	Low	0.28	5	4L
	12-44	0.6-2.0	0.15-0.20	7.9-8.4	Low	High	Low	0.28		
	44-62	0.6-2.0	0.13-0.18	7.9-8.4	Low	High	Low	0.28		

[1] This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 13.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. The definitions of "flooding" and "water table" in the Glossary explains such terms as "rare," "brief," and "perched." The symbol > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
Abilene:									
AbA, AbB	C	None	---	---	>6.0	---	---	>60	---
Bastrop:									
BaC, BbA, BbB	B	None	---	---	>6.0	---	---	>60	---
Bolar:									
BcB, BcC, BcD	C	None	---	---	>6.0	---	---	20-40	Rippable
Bonti:									
BnB	C	None	---	---	>6.0	---	---	20-40	Rippable
Bosque:									
Bo	B	Rare to common.	Brief	May-Oct	>6.0	---	---	>60	---
Brackett:									
[1]BrC:									
Brackett part	C	None	---	---	>6.0	---	---	10-20	Rippable
Bolar part	C	None	---	---	>6.0	---	---	20-40	Rippable
[1]BsE:									
Brackett part	C	None	---	---	>6.0	---	---	10-20	Rippable
Karnes part	B	None	---	---	>6.0	---	---	>60	---
[1]BTF	C	None	---	---	>6.0	---	---	10-20	Rippable
Chaney:									
ChC, ChC2, ChD, CmD, CnD3	C	None	---	---	>6.0	---	---	>60	---
Cisco:									
CoC	B	None	---	---	>6.0	---	---	>60	---
Deleon:									
Dc, De	C	Rare to common.	Brief	May-Oct	>6.0	---	---	>60	---
Demona:									
DmC	C	None	---	---	1.5-3.5	Perched	May-Oct	>60	---
Denton:									
DnB, DnC	D	None	---	---	>6.0	---	---	22-40	Rippable
Energy:									
Ee, [1]Ef	B	Rare to common.	Brief	May-Oct	>6.0	---	---	>60	---
Frio:									
Fr	B	Rare to common.	Brief	May-Oct	>6.0	---	---	>60	---
Hassee:									
HaA, HaB	D	None	---	---	1.0-2.0	Perched	May-Oct	>60	---

See footnote at end of table.

TABLE 13.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
Heaton:									
HdC	A	None	---	---	>6.0	---	---	>60	---
Hensley:									
HeB, HnB	D	None	---	---	>6.0	---	---	10-20	Hard
Karnes:									
KaC, KaD	B	None	---	---	>6.0	---	---	>60	---
Krum:									
KcA, KcB	D	None	---	---	>6.0	---	---	>60	---
Lamkin:									
La, [1]Lb	B	Rare to common.	Brief	May-Oct	>6.0	---	---	>60	---
Leeray:									
LcA, LcB	D	None	---	---	>6.0	---	---	>60	---
Lewisville:									
LeB, LeC	B	None	---	---	>6.0	---	---	>60	---
Luckenbach:									
LuB	C	None	---	---	>6.0	---	---	>60	---
May:									
MfA, MfB	B	None	---	---	>6.0	---	---	>60	---
Menard:									
MnB, MnC, MnD, [1]MsC2, [1]MsD3	B	None	---	---	>6.0	---	---	>60	---
Nimrod:									
NmC	C	None	---	---	1.5-3.5	Perched	May-Oct	>60	---
Owens:									
OcC, OwG	D	None	---	---	>6.0	---	---	10-20	Rip-pable
Patilo:									
[1]PaC:									
Patilo part	B	None	---	---	3.0-6.0	Perched	May-Oct	>60	---
Nimrod part	C	None	---	---	1.5-3.5	Perched	May-Oct	>60	---
Pedernales:									
PdC, PeB, PeC, PeD, [1]PsC2, [1]PsD3	C	None	---	---	>6.0	---	---	>60	---
Purves:									
PuB, PuC	D	None	---	---	>6.0	---	---	8-20	Hard
[1]PvG:									
Purves part	D	None	---	---	>6.0	---	---	8-20	Hard
Tarrant part	D	None	---	---	>6.0	---	---	6-20	Hard
[1]PXD:									
Purves part	D	None	---	---	>6.0	---	---	8-20	Hard
Bolar part	C	None	---	---	>6.0	---	---	20-40	Rip-pable
Sunev:									
SuC, SuD	B	None	---	---	>6.0	---	---	>60	---
Tarrant:									
[1]TAD	D	None	---	---	>6.0	---	---	6-20	Hard

See footnote at end of table.

TABLE 13.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
Tarrant:									
[1]TAF:									
Tarrant part.	D	None----------	—	—	>6.0	—	—	6-20	Hard
Rock outcrop part.									
Thurber:									
TrA, TrB----------	D	None----------	—	—	>6.0	—	—	>60	—
Truce:									
TuB, TuC2----------	C	None----------	—	—	>6.0	—	—	40-60	Rippable
[1]TxD:									
Truce part-------	C	None----------	—	—	>6.0	—	—	40-60	Rippable
Bonti part-------	C	None----------	—	—	>6.0	—	—	20-40	Rippable
[1]TyF:									
Truce part-------	C	None----------	—	—	>6.0	—	—	40-60	Rippable
Rock outcrop part.									
Venus:									
VeB---------------	B	None to common.	Very brief	May-Oct	>6.0	—	—	>60	—

---

[1] This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 14.—ENGINEERING TEST DATA

[Tests performed by the Texas Highway Department. For the location of each profile, see the section "Soil series and morphology"]

Soil name and report number	Depth	Shrinkage			Mechanical analysis[1]									Liquid limit	Plasticity index	Classification	
					Percentage passing sieve—						Percentage smaller than—						
		Limit	Linear	Ratio	2 in	3/8 in	No. 4	No. 10	No. 40	No. 200	0.05 mm	0.005 mm	0.002 mm			AASHTO[2]	Unified[3]
	In																
Abilene loam, 1 to 3 percent slopes:																	
71-423-R	0-6	15	7.8	1.86	100	100	100	100	99	65	55	21	15	30	14	A-6(8)	CL
71-424-R	6-22	16	15.5	1.89	100	100	100	100	99	76	70	43	35	51	31	A-7-6(18)	CH
Bonti fine sandy loam, 1 to 3 percent slopes:																	
71-416-R	0-8	19	0.8	1.73	100	100	99	97	95	56	37	11	8	21	3	A-4(4)	ML
71-417-R	8-22	15	11.2	1.91	100	100	99	99	98	73	62	44	41	37	10	A-6(12)	CL
Bosque loam, Occasionally flooded:																	
70-19-R	6-32	17	5.4	.82	100	100	100	100	98	55	44	19	15	27	12	A-6(5)	CL
70-20-R	32-42	17	7.1	.85	100	100	100	100	99	70	59	28	22	30	16	A-6(9)	CL
Chaney loamy sand, 1 to 5 percent slopes:																	
73-73-R	0-8	15	1.5	1.82	100	100	100	100	96	20	14	8	6	17	3	A-2-4(0)	SM
73-74-R	8-20	15	14.3	1.88	100	100	100	100	98	52	48	41	40	46	29	A-7-6(11)	CL
73-75-R	48-62	10	15.7	1.92	100	100	100	100	97	59	54	39	38	48	32	A-7-6(14)	CL
Deleon clay, occasionally flooded:																	
70-27-R	22-36	13	17.5	1.93	100	100	100	100	100	98	91	62	47	54	31	A-7-6(19)	CH
Demona loamy sand, 0 to 5 percent:																	
71-418-R	0-6	17	0	1.78	100	100	100	99	94	13	10	5	4	20	3	A-2-4(0)	SM
71-419-R	36-52	16	14.0	1.88	100	100	99	99	99	68	62	49	48	50	50	A-7-6(16)	CL or CH
Denton silty clay, 1 to 3 percent slopes:																	
71-425-R	12-24	13	20.3	1.97	100	100	100	99	97	93	83	54	42	63	30	A-7-5(20)	MH
Frio clay loam, Occasionally flooded:																	
70-21-R	18-36	14	16.3	1.94	100	100	100	100	100	90	81	56	47	51	30	A-7-6{18}	CH
70-21-R	50-62	19	10.5	1.80	100	100	100	99	97	84	78	55	42	40	21	A-6(12)	CL
Hassee loam, 1 to 3 percent slopes:																	
71-420-R	0-8	16	4.5	1.81	100	100	100	100	99	76	65	28	17	24	9	A-4(8)	CL
71-421-R	12-20	15	13.8	1.88	100	100	100	100	100	82	75	56	48	45	45	A-7-6(15)	CL
71-422-R	42-60	16	13.3	1.88	100	100	100	100	99	82	75	46	33	44	25	A-7-6(15)	CL

See footnotes at end of table.

TABLE 14.—ENGINEERING TEST DATA—Continued

Soil name and report number	Depth	Shrinkage			Mechanical analysis[1] Percentage passing sieve—						Mechanical analysis[1] Percentage smaller than—			Liquid limit	Plasticity index	Classification	
		Limit	Linear	Ratio	2 in	3/8 in	No. 4	No. 10	No. 40	No. 200	0.05 mm	0.005 mm	0.002 mm			AASHTO[2]	Unified[3]
	In																
Karnes loam, 1 to 5 percent slopes:																	
70-33-R	8-24	16	4.5	1.84	100	100	99	98	93	53	45	26	19	25	9	A-4(3)	CL
70-34-R	24-40	16	3.3	1.85	100	100	99	98	89	42	34	19	13	21	5	A-4{1}	SC-SM
70-35-R	48-54	18	2.3	1.78	100	100	99	98	89	37	29	13	10	22	4	A-4(0)	SC-SM
Menard fine sandy loam, 3 to 5 percent slopes:																	
71-430-R	0-10	20	0.8	1.64	100	100	100	99	99	55	34	9	7	22	3	A-4(4)	ML
71-431-R	10-18	19	4.7	1.72	100	100	100	100	100	61	49	22	21	28	11	A-6(5)	CL
71-432-R	34-60	18	4.7	1.77	100	100	100	99	98	59	47	21	17	27	10	A-4(5)	CL
Nimrod fine sand, 0 to 5 percent slopes:																	
71-414-R	6-26	18	0	1.77	100	100	100	100	100	10	7	2	2	20	2	A-3(0))	SM-SP
71-415-R	34-52	16	4.5	1.78	100	100	100	100	100	33	29	21	20	23	11	A-2-6(0))	SC
Venus loam, 1 to 3 percent slopes:																	
70-36-R	6-12	16	3.4	1.82	100	100	100	100	97	55	42	13	9	22	5	A-4(4)	CL-ML
70-37-R	12-20	16	5.2	1.86	100	100	100	99	96	58	46	23	18	25	10	A-4(5)	CL
70-38-R	44-62	15	6.5	1.89	100	100	80	74	66	44	35	18	14	27	13	A-6(3)	SC

---

[1] Mechanical analyses according as to AASHTO Designation T 88. Results by this procedure frequently differ somewhat from results that would have been obtained by this soil variety porcedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analysed by the hydrometer method and the various grain-sized fractions are calcareous on the basis of all th material, including that coarser than 2 milimeter in diameter. In the SCS soil survey procedure, the fine material is analysed by the pipette method and the material coarser than 2 milimeter in diameter is exluded from calculations of grain-sized fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

[2] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 8): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHTO Designation M 145-49.

[3] Based on the Unified Soil Classification System.

TABLE 15.—CLASSIFICATION OF THE SOILS

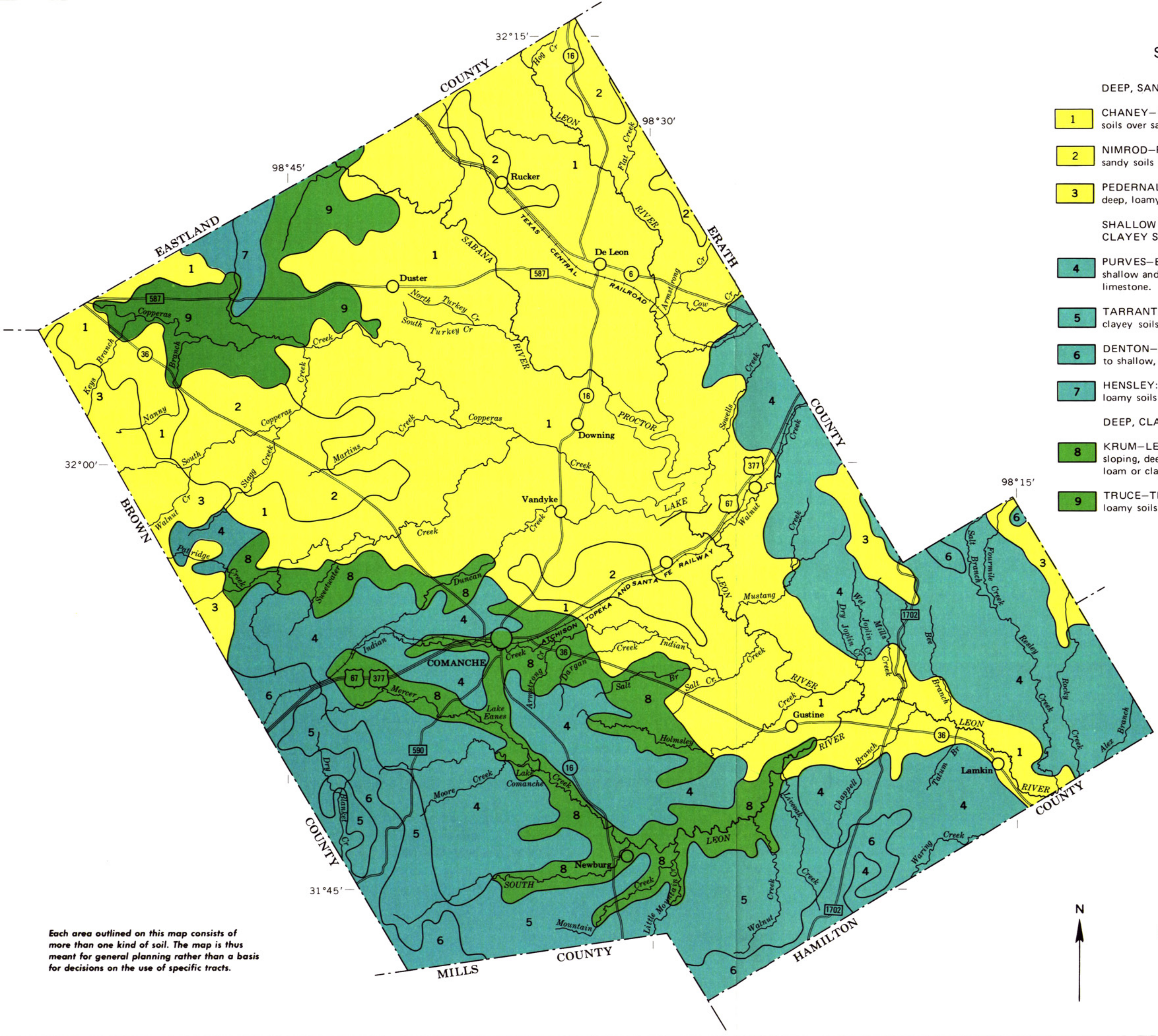
Soil name	Family or higher taxonomic class
Abilene	Fine, mixed, thermic Pachic Argiustolls
Bastrop	Fine-loamy, mixed, thermic Udic Paleustalfs
Bolar	Fine-loamy, carbonatic, thermic Typic Calciustolls
Bonti	Fine, mixed, thermic Ultic Paleustalfs
Bosque	Fine-loamy, mixed, thermic Cumulic Haplustolls
Brackett	Loamy, carbonatic, thermic, shallow Typic Ustochrepts
Chaney	Fine, mixed, thermic Aquic Paleustalfs
Cisco	Fine-loamy, siliceous, thermic Udic Haplustalfs
Deleon	Fine, mixed, thermic Udertic Haplustolls
Demona	Clayey, mixed, thermic Aquic Arenic Paleustalfs
Denton	Fine, montmorillonitic, thermic Vertic Calciustolls
Energy	Fine-loamy, mixed (calcareous), thermic Typic Ustifluvents
Frio	Fine, mixed, thermic Cumulic Haplustolls
Hassee	Fine, montmorillonitic, thermic Mollic Albaqualfs
Heaton	Loamy, siliceous, thermic Arenic Paleustalfs
Hensley	Clayey, mixed, thermic Lithic Rhodustalfs
Karnes	Coarse-loamy, carbonatic, thermic Typic Ustochrepts
Krum	Fine, montmorillonitic, thermic Vertic Haplustolls
Lamkin	Fine-silty, mixed, thermic Fluventic Haplustolls
Leeray	Fine, montmorillonitic, thermic Typic Chromusterts
Lewisville	Fine-silty, mixed, thermic Typic Calciustolls
Luckenbach	Fine, mixed, thermic Typic Argiustolls
May	Fine-loamy, mixed, thermic Udic Haplustalfs
Menard	Fine-loamy, mixed, thermic Typic Haplustalfs
Nimrod	Loamy, siliceous, thermic Aquic Arenic Paleustalfs
Owens	Clayey, mixed, thermic, shallow Typic Ustochrepts
Patilo	Loamy, siliceous, thermic Grossarenic Paleustalfs
Pedernales	Fine, mixed, thermic Udic Paleustalfs
Purves	Clayey, montmorillonitic, thermic Lithic Calciustolls
Sunev	Fine-loamy, carbonatic, thermic Typic Calciustolls
Tarrant	Clayey-skeletal, montmorillonitic, thermic Lithic Calciustolls
Thurber	Fine, montmorillonitic, thermic Typic Haplustalfs
Truce	Fine, mixed, thermic Udic Paleustalfs
Venus	Fine-loamy, mixed, thermic Typic Calciustolls

☆ U.S. GOVERNMENT PRINTING OFFICE: 1977— 236-742/44

NRCS Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.



Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SOIL ASSOCIATIONS

DEEP, SANDY AND LOAMY SOILS

1	CHANEY–DEMONA: Nearly level to sloping, deep, sandy soils over sandy clay or sandy clay loam.
2	NIMROD–PATILO: Nearly level to gently sloping, deep, sandy soils over sandy clay loam.
3	PEDERNALES–MENARD: Gently sloping to sloping, deep, loamy soils over limey sandy clay loam.

SHALLOW TO MODERATELY DEEP, LOAMY AND CLAYEY SOILS

4	PURVES–BOLAR: Gently sloping to sloping, stony, shallow and moderately deep, clayey and loamy soils over limestone.
5	TARRANT: Gently sloping to steep, cobbly, shallow, clayey soils over limestone.
6	DENTON–PURVES: Gently sloping, moderately deep to shallow, clayey soils over limestone.
7	HENSLEY: Gently sloping to sloping, stony, shallow, loamy soils over limestone.

DEEP, CLAYEY AND LOAMY SOILS

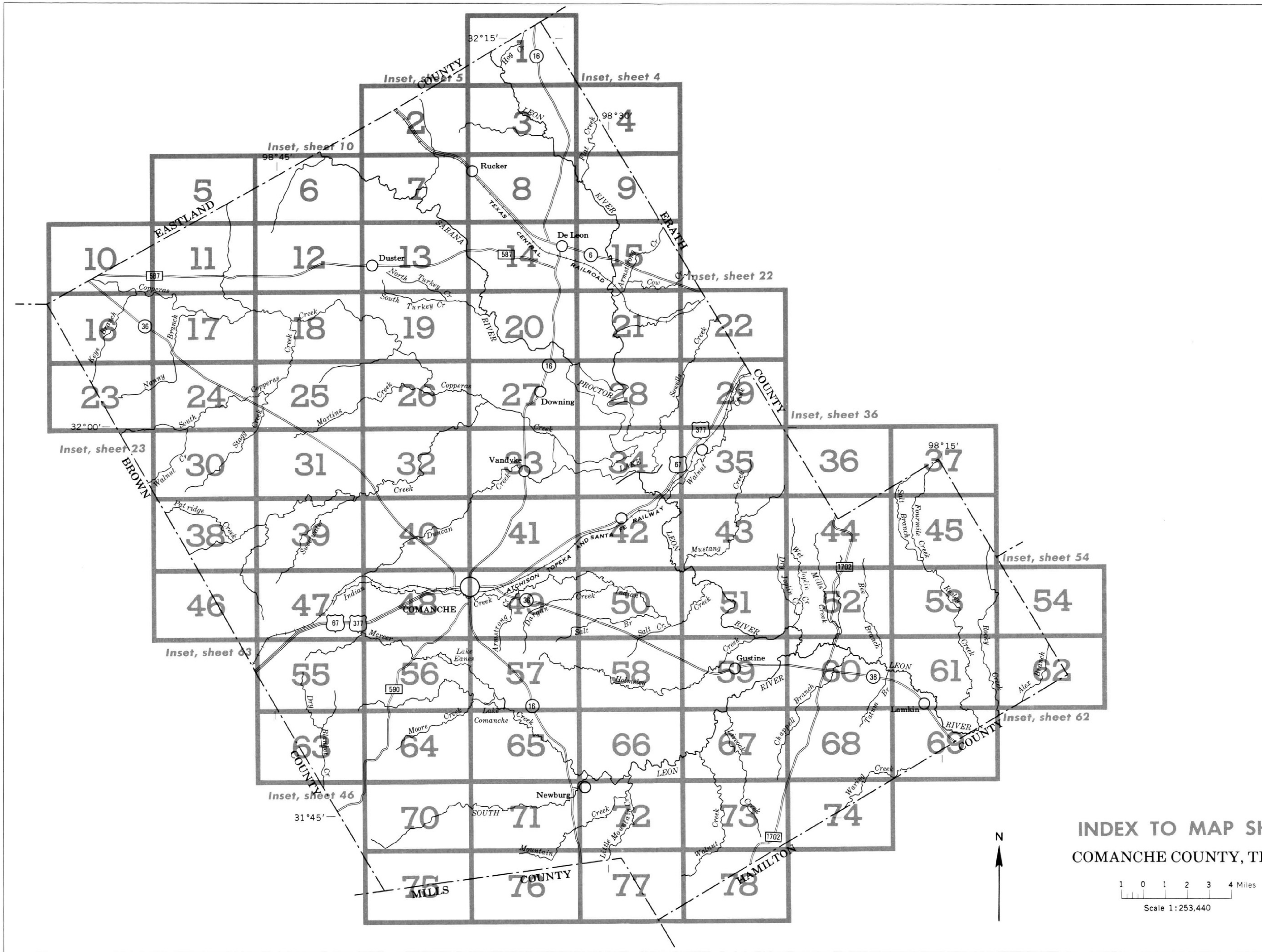
8	KRUM–LEWISVILLE–ABILENE: Nearly level to gently sloping, deep, loamy and clayey soils over limey silty clay loam or clay loam.
9	TRUCE–THURBER: Nearly level to gently sloping, deep, loamy soils over clay or clay loam.

Compiled 1977

GENERAL SOIL MAP
COMANCHE COUNTY, TEXAS

1 0 1 2 3 4 Miles

Scale 1:253,440



INDEX TO MAP SHEETS

COMANCHE COUNTY, TEXAS

SOIL LEGEND

The first capital letter is the initial one of the soil name. The second letter is a lowercase letter for a narrowly defined mapping unit and a capital letter for a broadly defined mapping unit. The third letter is a capital letter that indicates slope. Symbols without a slope letter are those of nearly level soils. A final number, 2 or 3, in the symbol shows that the soil is eroded or severely eroded.

Consecutive capital letters in the map symbol indicate the delineations are much larger and the composition of the units is apt to be more variable than the other units in the survey area. Mapping has been controlled well enough, however, for the anticipated use of the areas involved.

SYMBOL	NAME
AbA	Abilene loam, 0 to 1 percent slopes
AbB	Abilene loam, 1 to 3 percent slopes
BaC	Bastrop loamy fine sand, 1 to 5 percent slopes
BbA	Bastrop fine sandy loam, 0 to 1 percent slopes
BbB	Bastrop fine sandy loam, 1 to 3 percent slopes
BcB	Bolar clay loam, 1 to 3 percent slopes
BcC	Bolar clay loam, 3 to 5 percent slopes
BcD	Bolar clay loam, 5 to 8 percent slopes
BnB	Bonti fine sandy loam, 1 to 3 percent slopes
Bo	Bosque loam, occasionally flooded
BrC	Brackett-Bolar complex, 1 to 5 percent slopes
BsE	Brackett-Karnes complex, 1 to 12 percent slopes
BTF	Brackett soils, hilly
ChC	Chaney laomy sand, 1 to 5 percent slopes
ChC2	Chaney loamy sand, 1 to 5 percent slopes, eroded
ChD	Chaney loamy sand, 5 to 8 percent slopes
CmD	Chaney stony loamy sand, 1 to 8 percent slopes
CnD3	Chaney soils, 1 to 8 percent slopes, severely eroded
CoC	Cisco loamy fine sand, 1 to 5 percent slopes
Dc	Deleon clay, occasionally flooded
De	Deleon clay, frequently flooded
DmC	Demona loamy sand, 0 to 5 percent slopes
DnB	Denton silty clay, 1 to 3 percent slopes
DnC	Denton silty clay, 3 to 5 percent slopes
Ee	Energy fine sandy loam, occasionally flooded
Ef	Energy soils, frequently flooded
Fr	Frio clay loam, occasionally flooded
HaA	Hassee loam, 0 to 1 percent slopes
HaB	Hassee loam, 1 to 3 percent slopes
HdC	Heaton loamy fine sand, 0 to 5 percent slopes
HeB	Hensley loam, 1 to 3 percent slopes
HnB	Hensley stony loam, 0 to 3 percent slopes
KaC	Karnes loam, 1 to 5 percent slopes
KaD	Karnes loam, 5 to 8 percent slopes
KcA	Krum silty clay, 0 to 1 percent slopes
KcB	Krum silty clay, 1 to 3 percent slopes
La	Lamkin clay loam, occasionally flooded
Lb	Lamkin soils, frequently flooded
LcA	Leeray clay, 0 to 1 percent slopes
LcB	Leeray clay, 1 to 3 percent slopes
LeB	Lewisville clay loam, 1 to 3 percent slopes
LeC	Lewisville clay loam, 3 to 5 percent slopes
LuB	Luckenbach clay loam, 1 to 3 percent slopes
MfA	May fine sandy loam, 0 to 1 percent slopes
MfB	May fine sandy loam, 1 to 3 percent slopes
MnB	Menard fine sandy loam, 1 to 3 percent slopes
MnC	Menard fine sandy loam, 3 to 5 percent slopes
MnD	Menard fine sandy loam, 5 to 8 percent slopes
MsC2	Menard soils, 1 to 5 percent slopes, eroded
MsD3	Menard soils, 1 to 8 percent slopes, severely eroded
NmC	Nimrod fine sand, 0 to 5 percent slopes
OcC	Owens clay, 1 to 5 percent slopes
OwG	Owens stony clay, 3 to 25 percent slopes
PaC	Patilo-Nimrod complex, 0 to 5 percent slopes
PdC	Pedernales loamy fine sand, 1 to 5 percent slopes
PeB	Pedernales fine sandy loam, 1 to 3 percent slopes
PeC	Pedernales fine sandy loam, 3 to 5 percent slopes
PeD	Pedernales fine sandy loam, 5 to 8 percent slopes
PsC2	Pedernales soils, 1 to 5 percent slopes, eroded
PsD3	Pedernales soils, 1to 8 percent slopes, severely eroded
PuB	Purves clay, 1 to 3 percent slopes
PuC	Purves clay, 3 to 5 percent slopes
PvG	Purves-Tarrant complex, 8 to 40 percent slopes
PXD	Purves-Bolar association, undulating
SuC	Sunev clay loam, 3 to 5 percent slopes
SuD	Sunev clay loam, 5 to 8 percent slopes
TAD	Tarrant association, undulating
TAF	Tarrant-Rock outcrop association, hilly
TrA	Thurber clay loam, 0 to 1 percent slopes
TrB	Thurber clay loam, 1 to 3 percent slopes
TuB	Truce fine sandy loam, 1 to 3 percent slopes
TuC2	Truce fine sandy loam, 1 to 5 percent slopes, eroded
TxD	Truce-Bonti complex, 1 to 8 percent slopes
TyF	Truce-Rock outcrop complex, 8 to 20 percent slopes
VeB	Venus loam, 1 to 3 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool — Davis Airstrip; FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate — 79
- Federal — 410
- State — 52
- County, farm or ranch — 378

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water; w

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas) ▪
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — GAS ●
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water; w
- Intermittent — int; i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — CeA FoB2

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

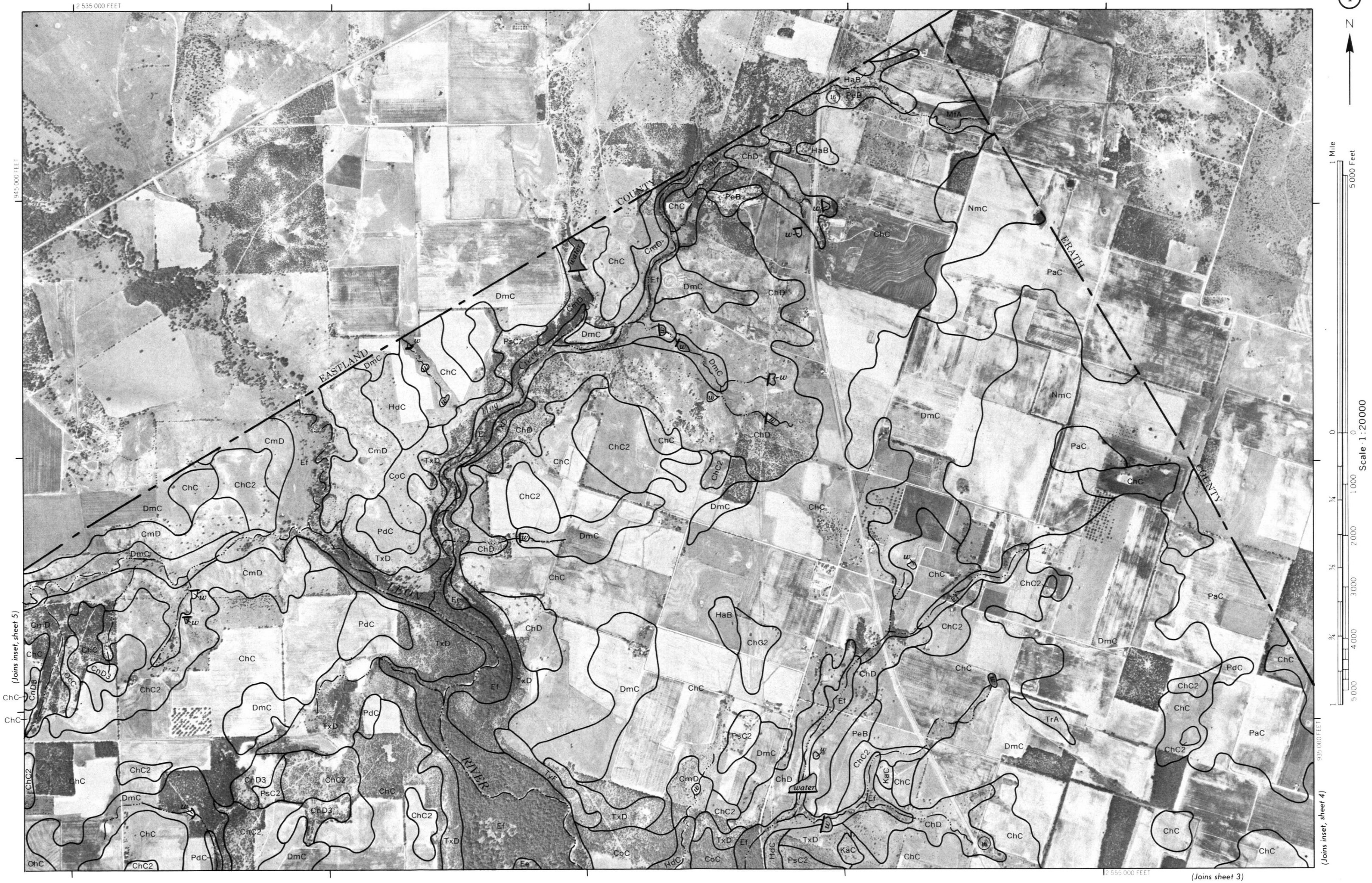
DEPRESSION OR SINK ◊

SOIL SAMPLE SITE (normally not shown) Ⓢ

MISCELLANEOUS

- Blowout
- Clay spot ※
- Gravelly spot
- Gumbo, slick or scabby spot (sodic) ø
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale) v
- Saline spot +
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot 0

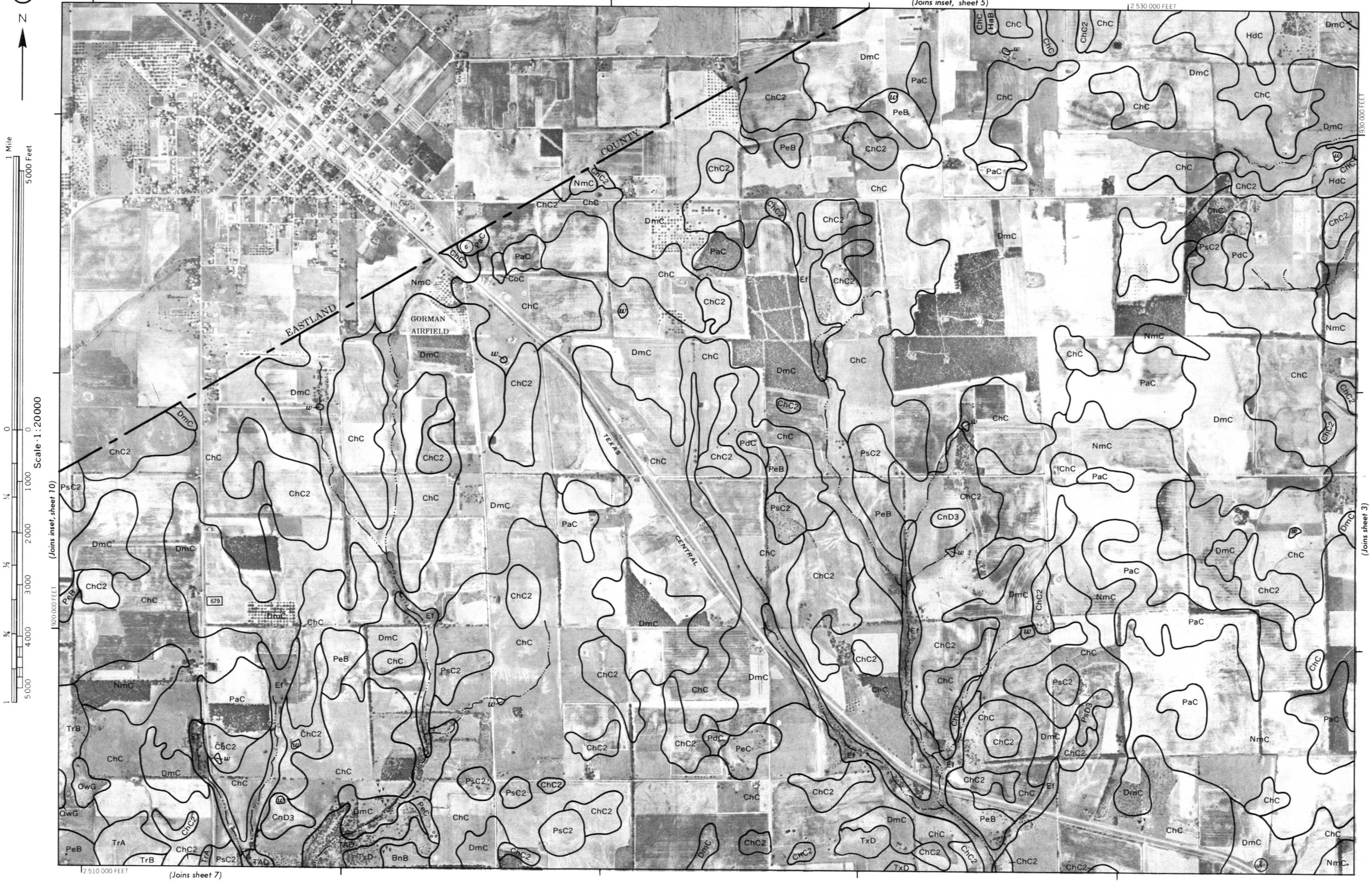
COMANCHE COUNTY, TEXAS — SHEET NUMBER 1



COMANCHE COUNTY, TEXAS NO. 1

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS — SHEET NUMBER 2



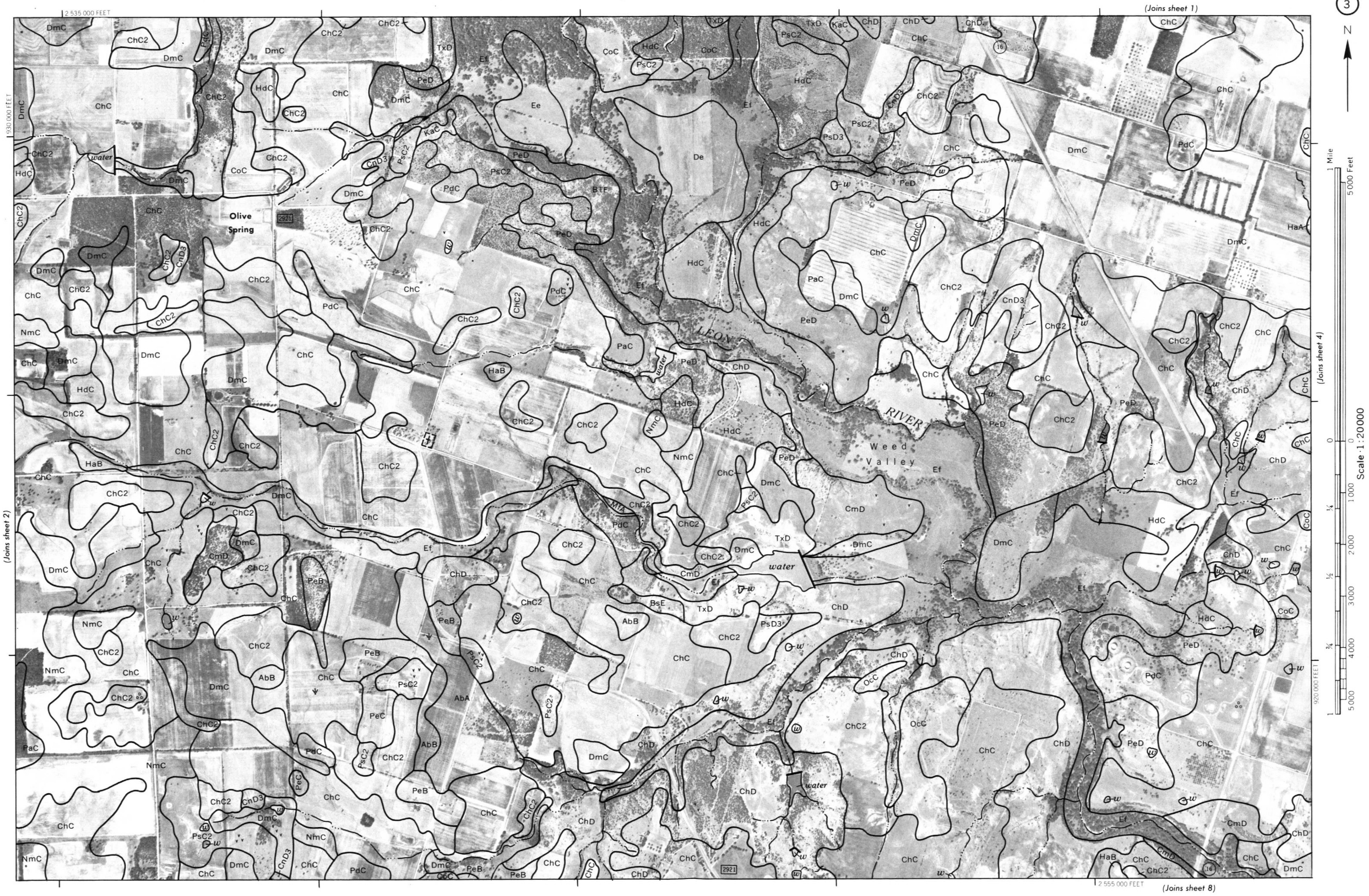
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 2

COMANCHE COUNTY, TEXAS — SHEET NUMBER 3

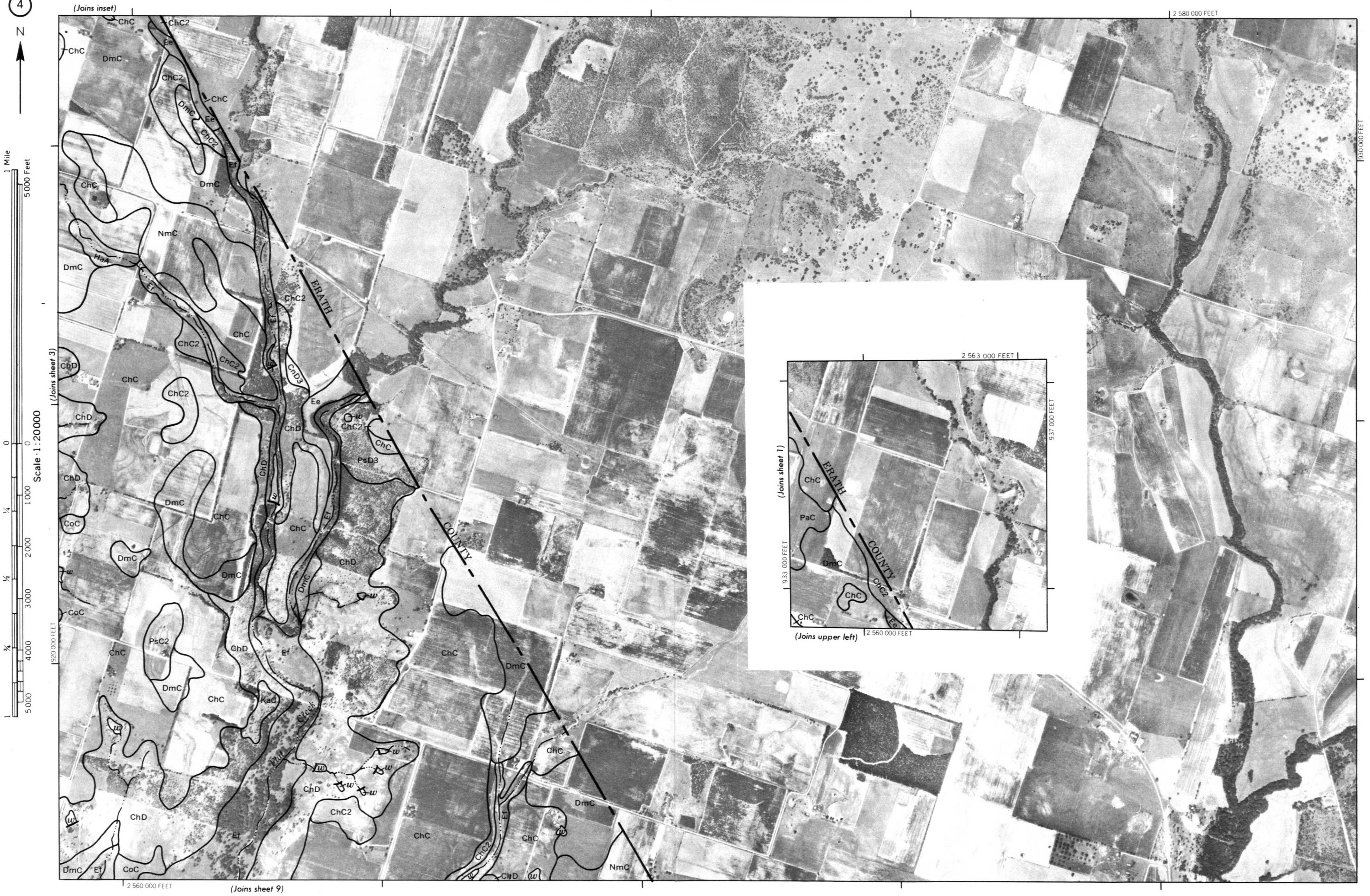
COMANCHE COUNTY, TEXAS NO. 3

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



④

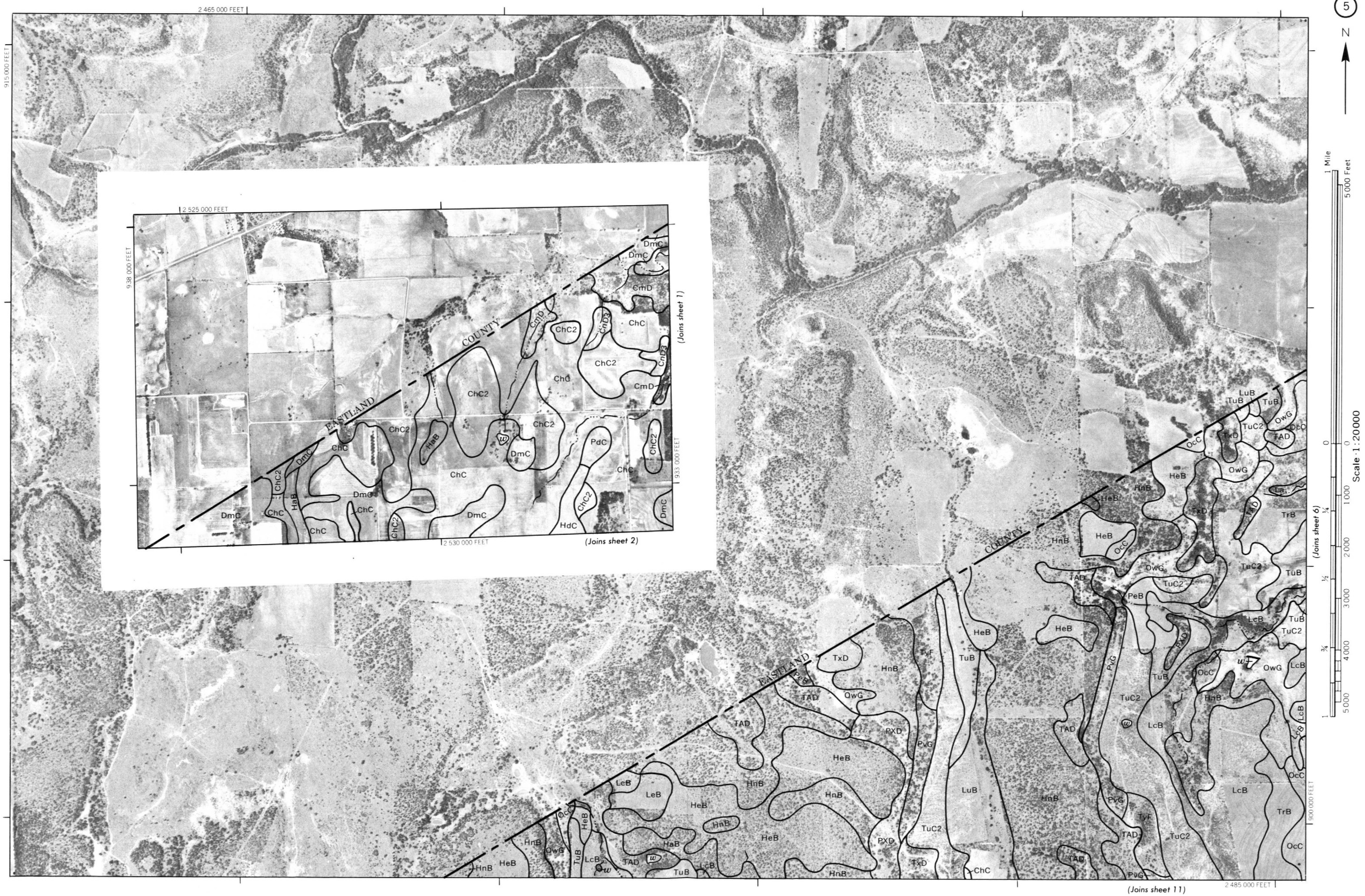
COMANCHE COUNTY, TEXAS — SHEET NUMBER 4



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 4

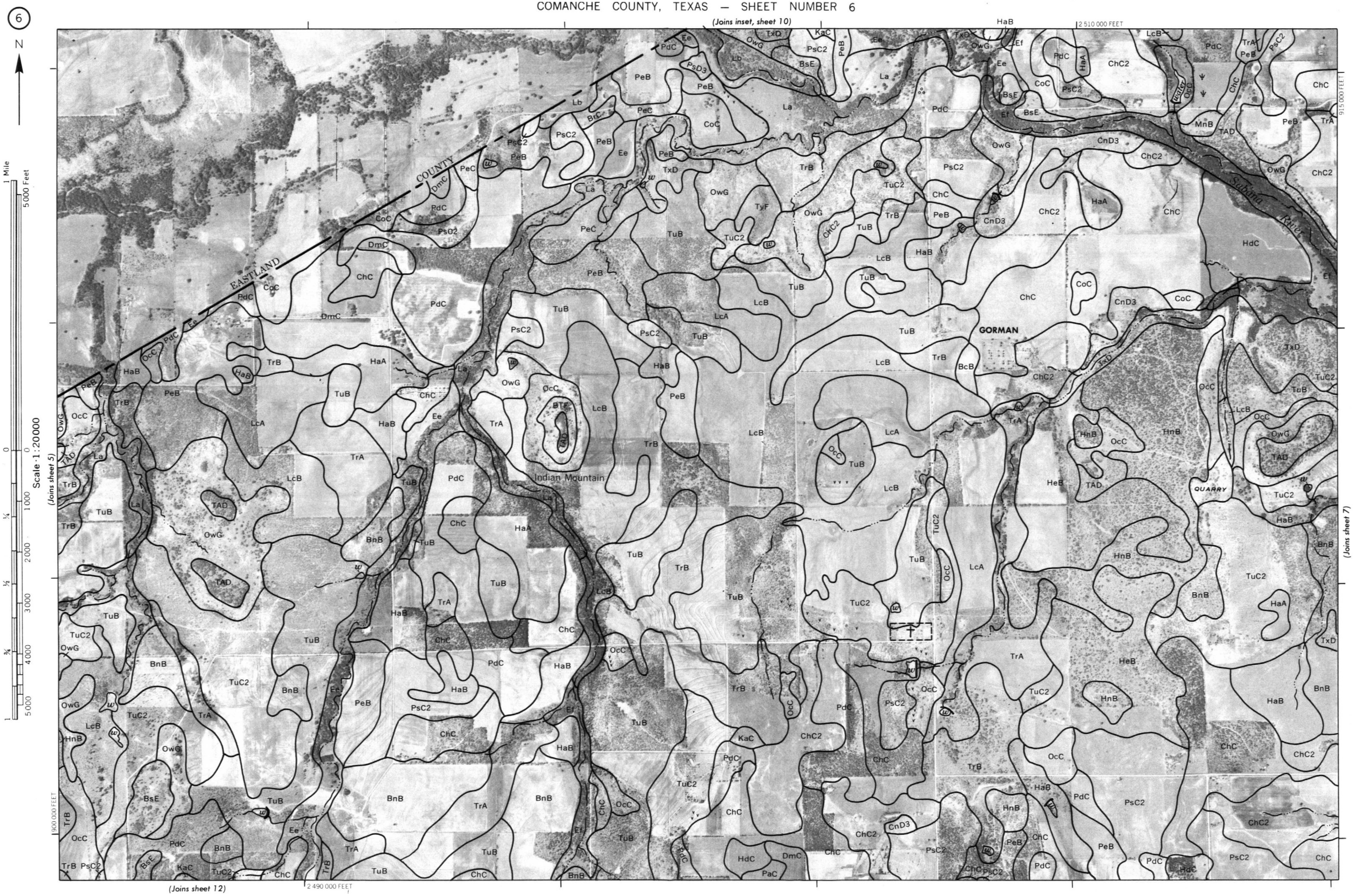
COMANCHE COUNTY, TEXAS — SHEET NUMBER 5



COMANCHE COUNTY, TEXAS NO. 5

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

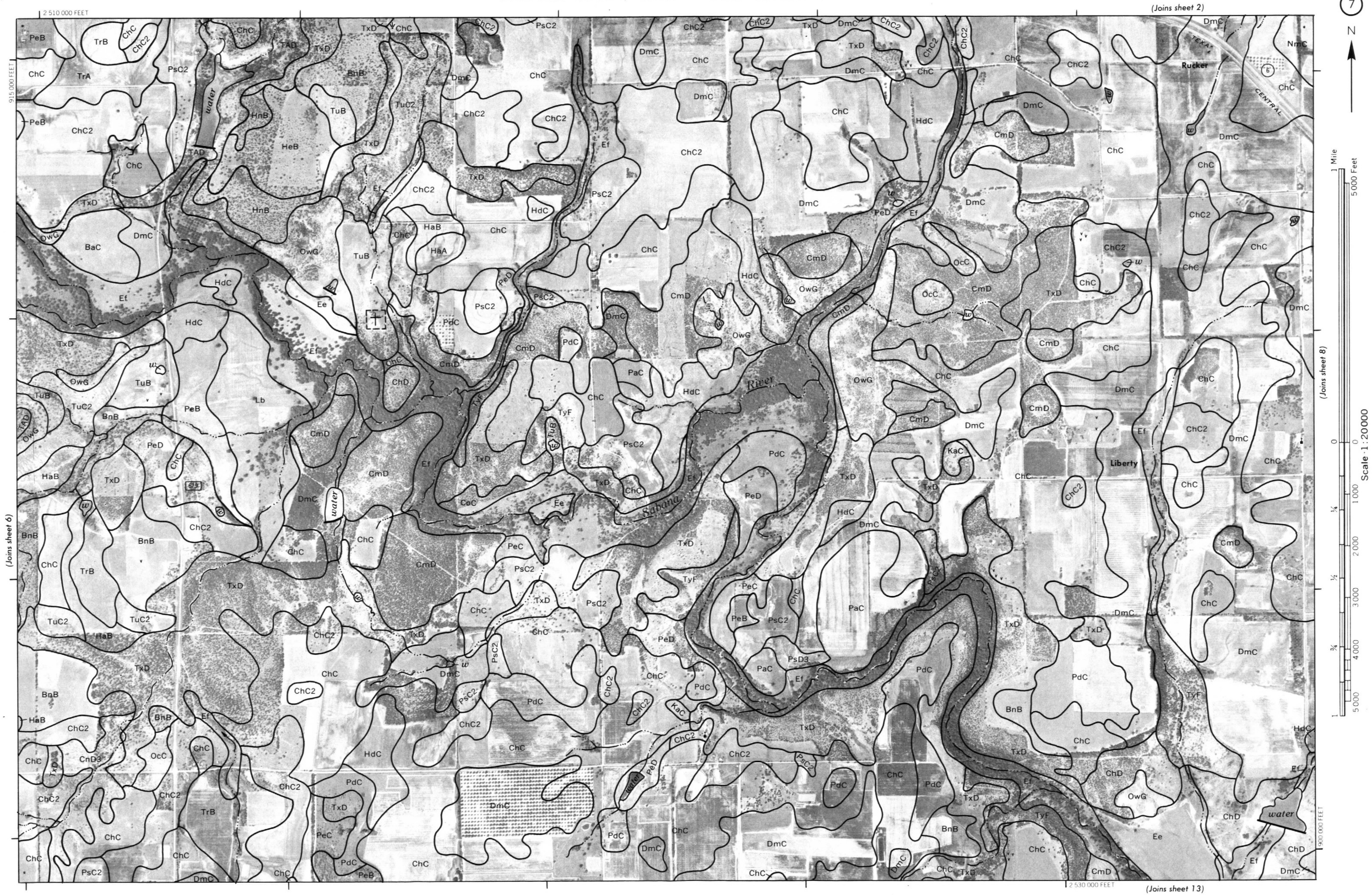
COMANCHE COUNTY, TEXAS — SHEET NUMBER 6



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 6

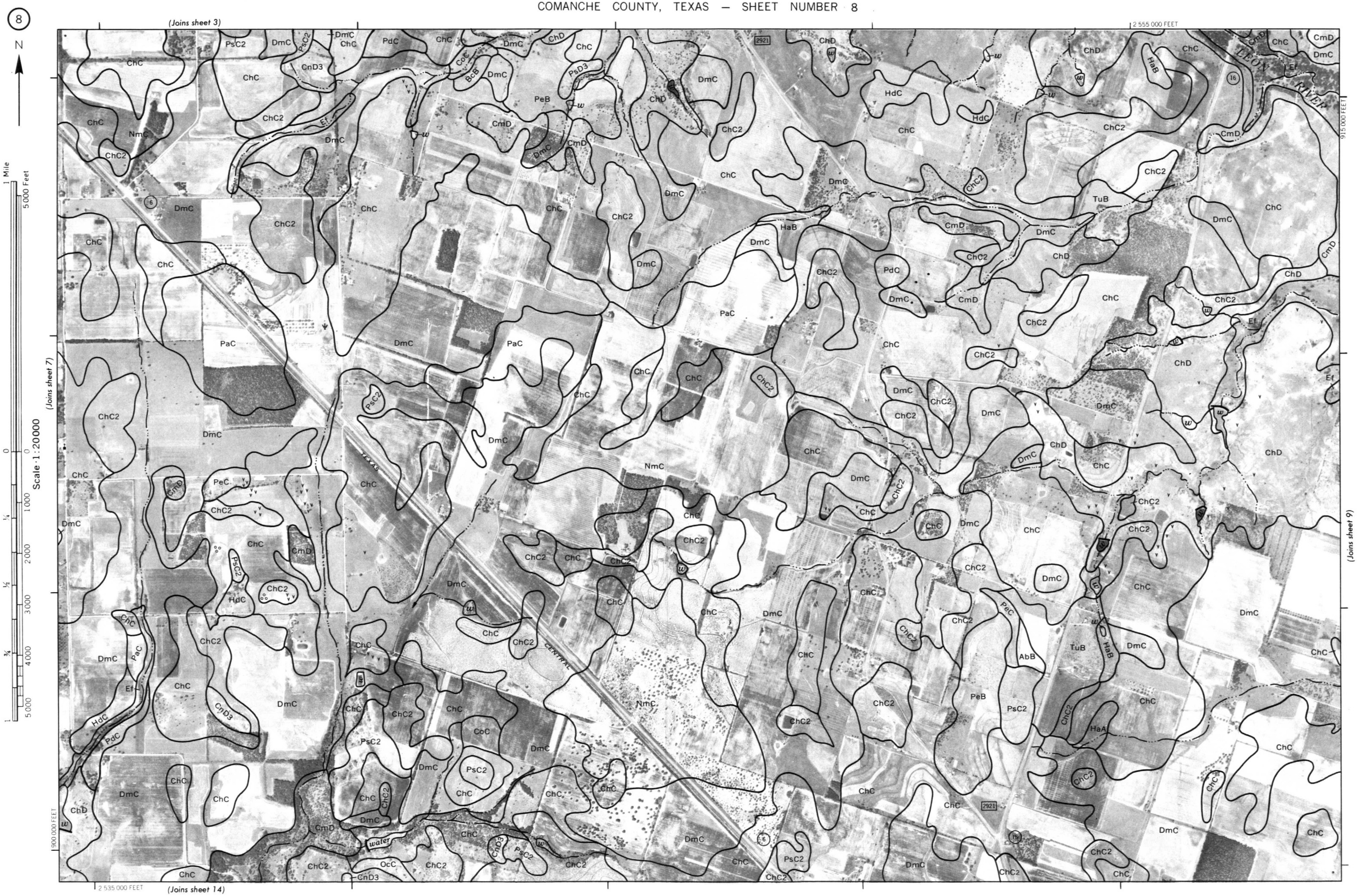
COMANCHE COUNTY, TEXAS — SHEET NUMBER 7



COMANCHE COUNTY, TEXAS NO. 7

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

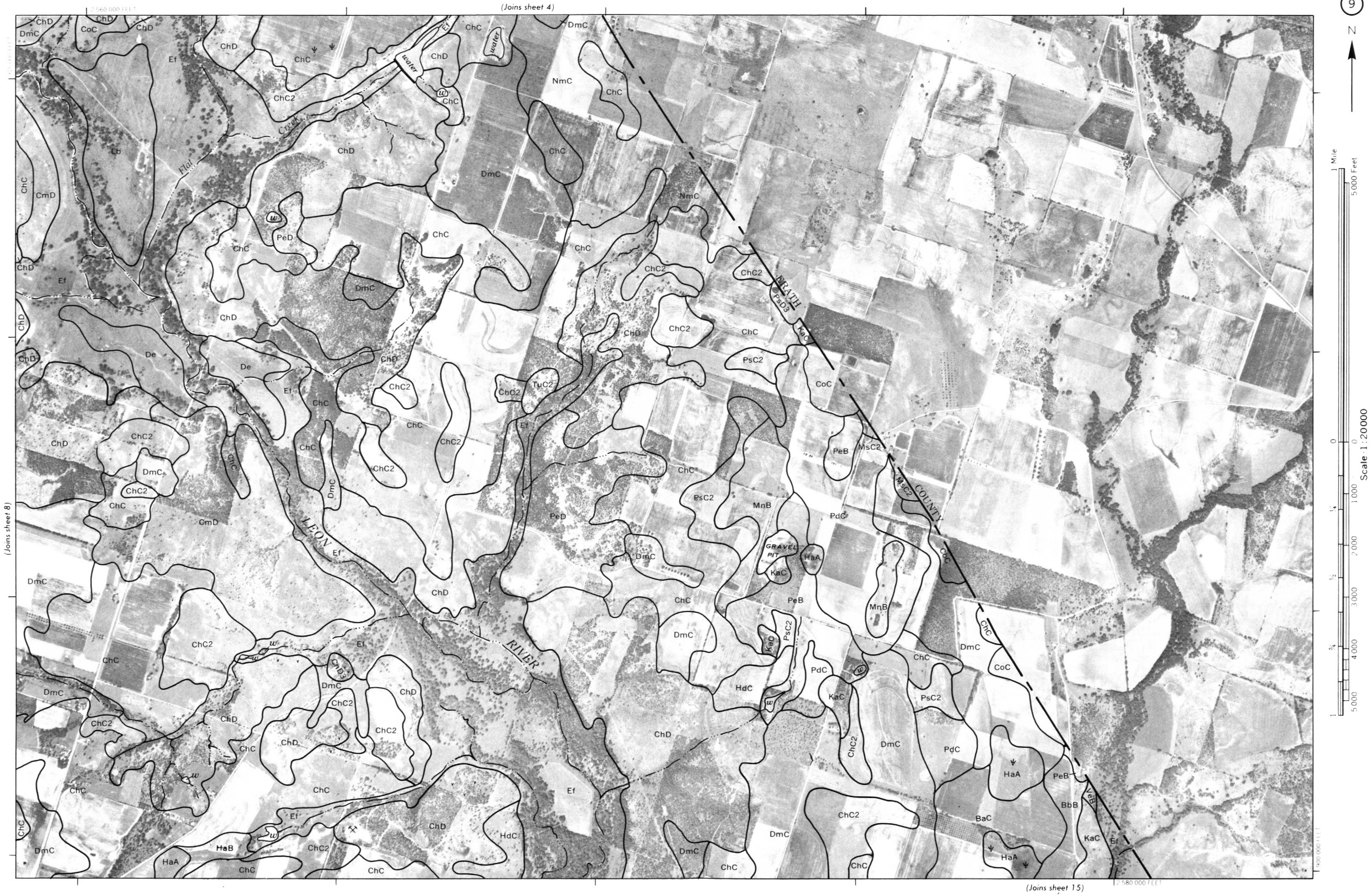
COMANCHE COUNTY, TEXAS — SHEET NUMBER 8



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 8

COMANCHE COUNTY, TEXAS — SHEET NUMBER 9

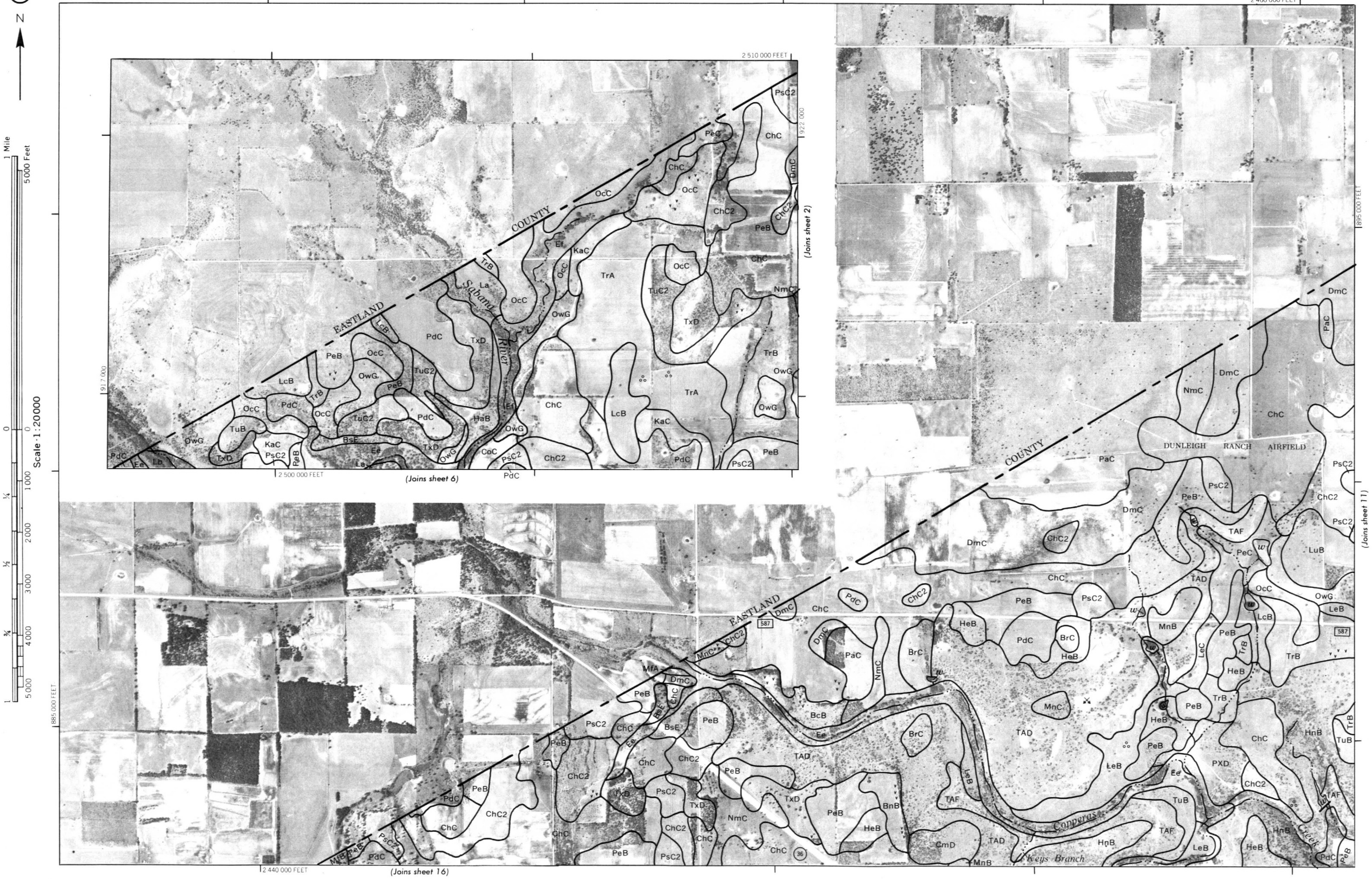


COMANCHE COUNTY, TEXAS NO. 9

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

⑩

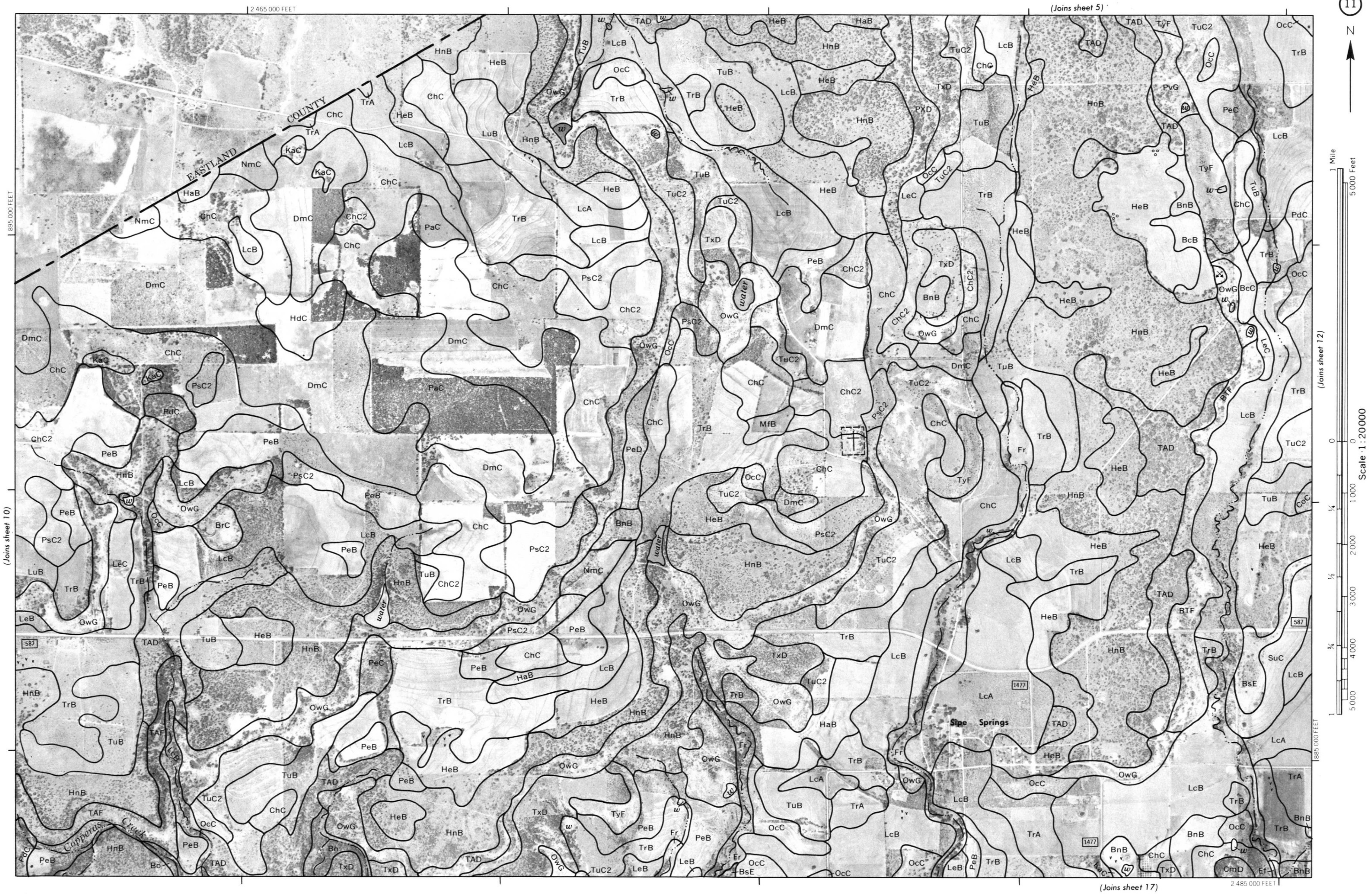
COMANCHE COUNTY, TEXAS — SHEET NUMBER 10



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 10

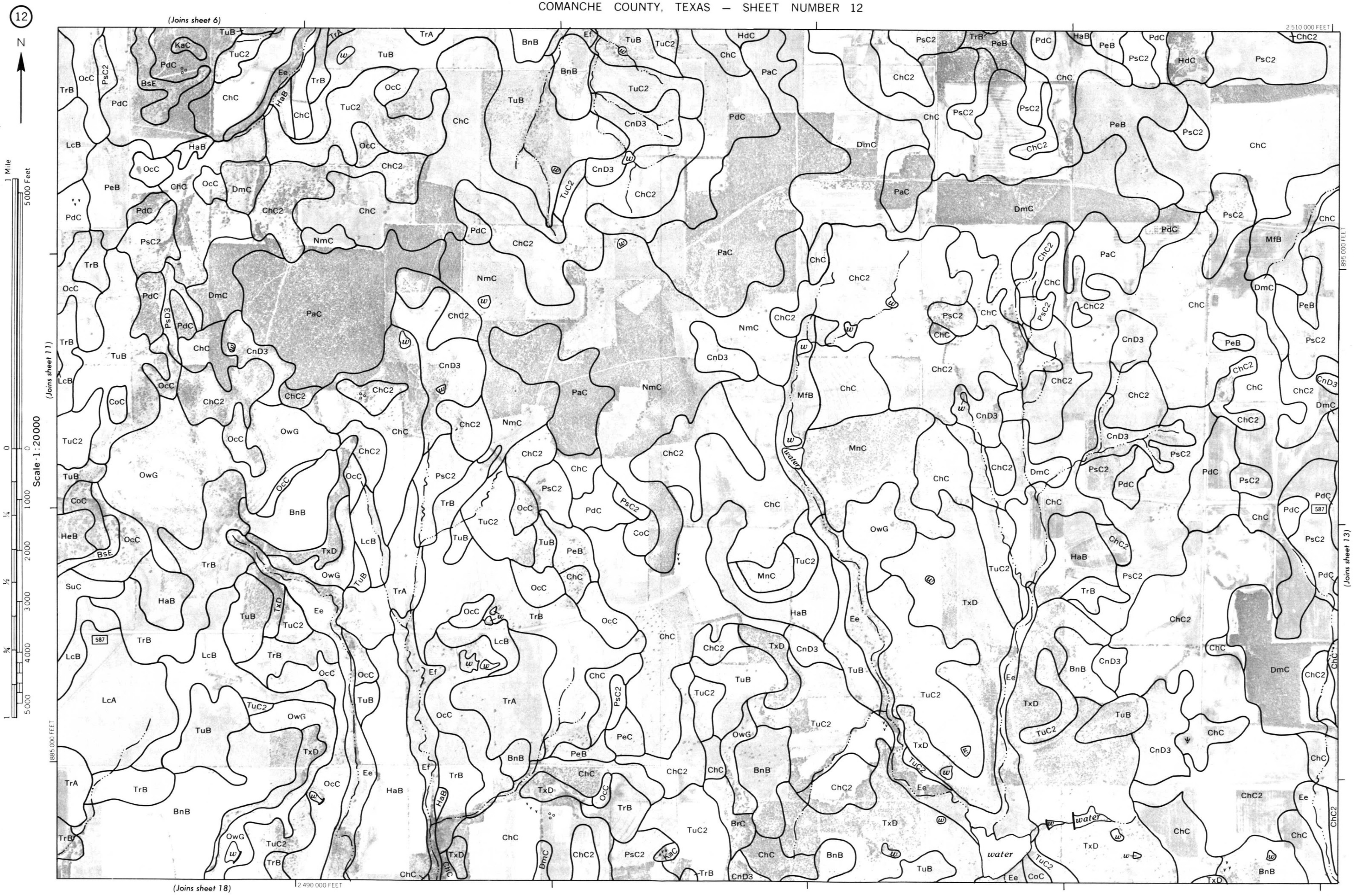
COMANCHE COUNTY, TEXAS — SHEET NUMBER 11



COMANCHE COUNTY, TEXAS NO. 11.

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

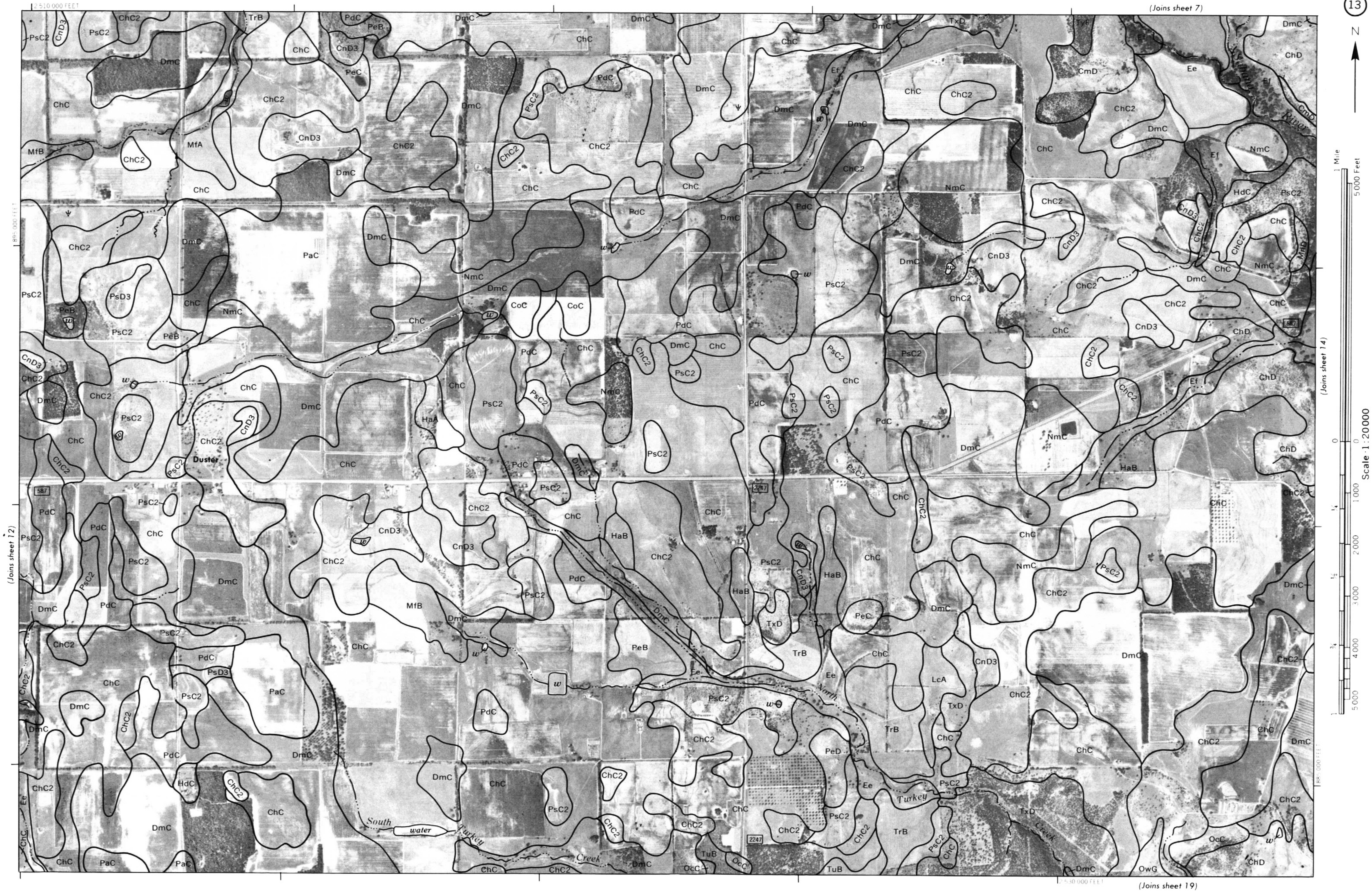
COMANCHE COUNTY, TEXAS — SHEET NUMBER 12



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 12

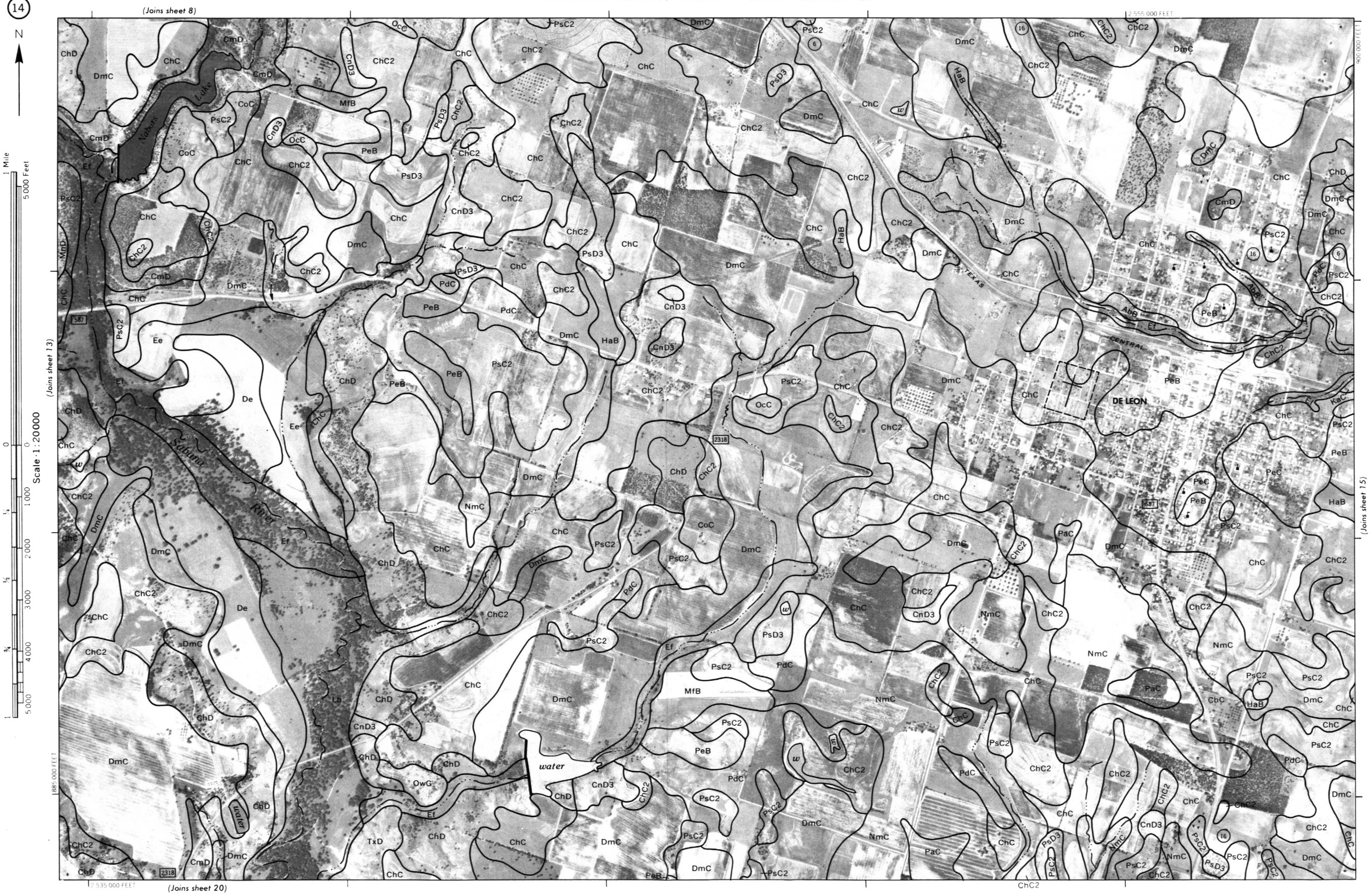
COMANCHE COUNTY, TEXAS — SHEET NUMBER 13



COMANCHE COUNTY, TEXAS NO. 13

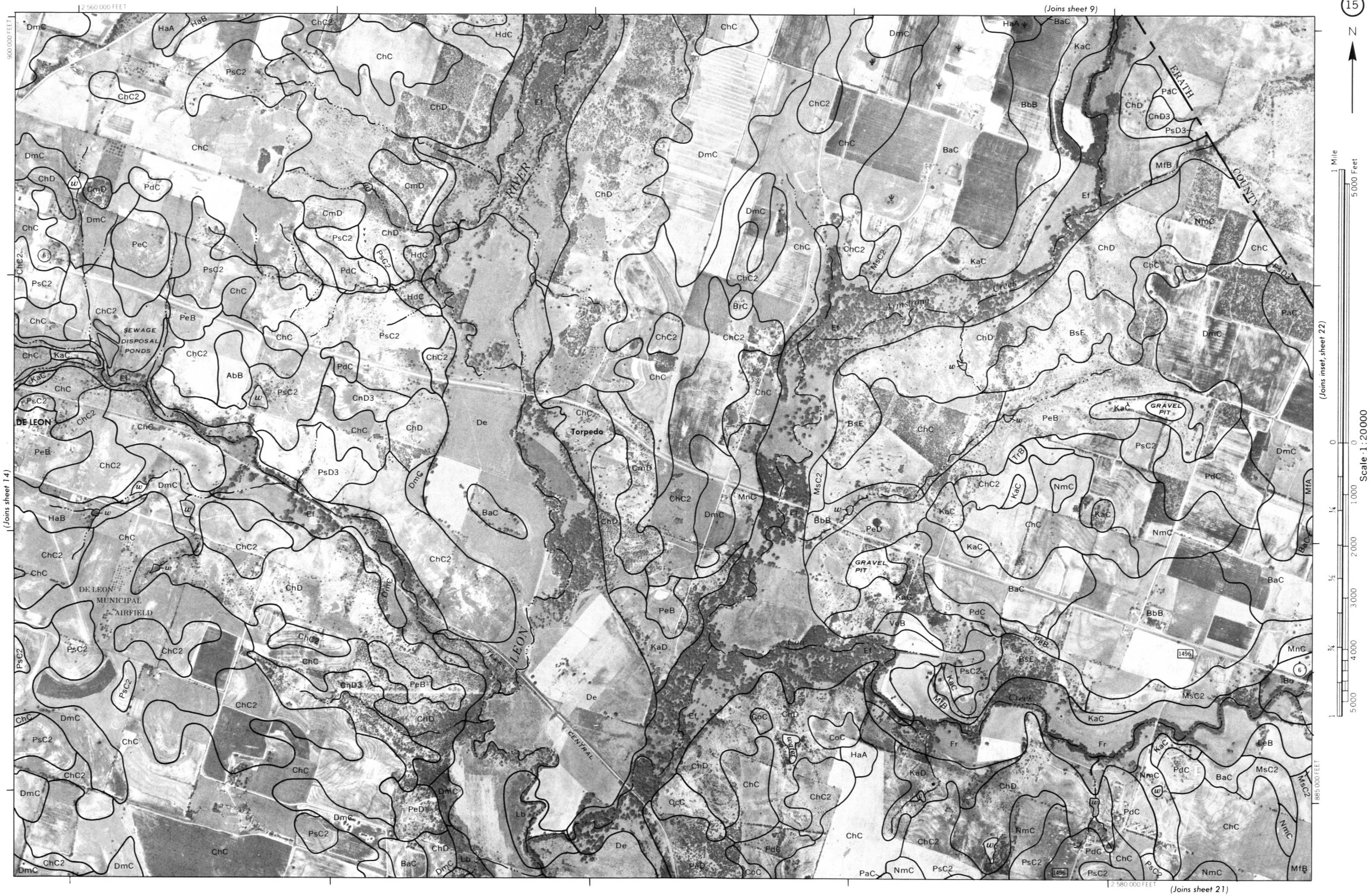
This map is compiled on 1974 aerial photographs by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS — SHEET NUMBER 14



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

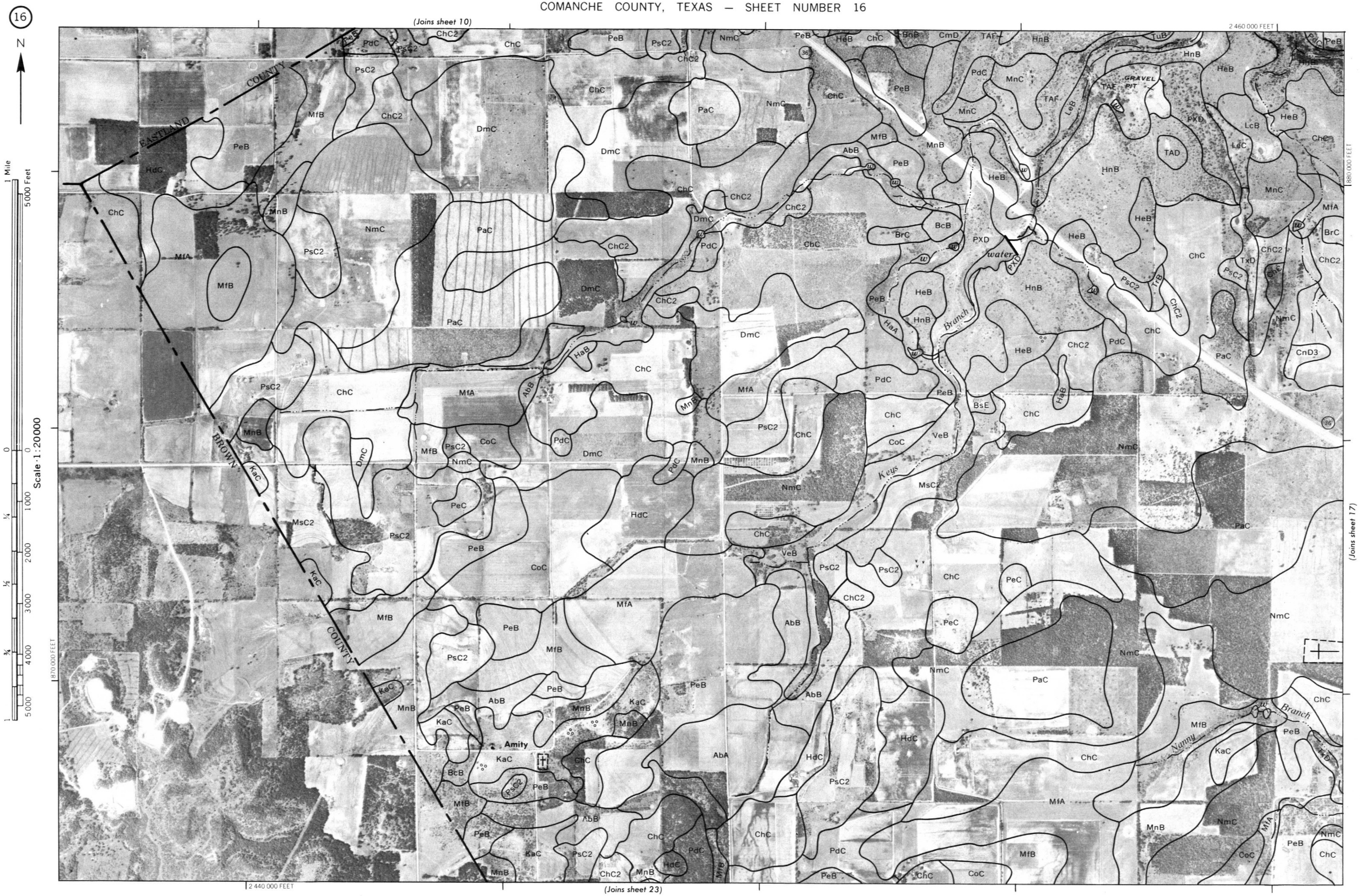
COMANCHE COUNTY, TEXAS NO. 14



COMANCHE COUNTY, TEXAS NO. 15

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS — SHEET NUMBER 16



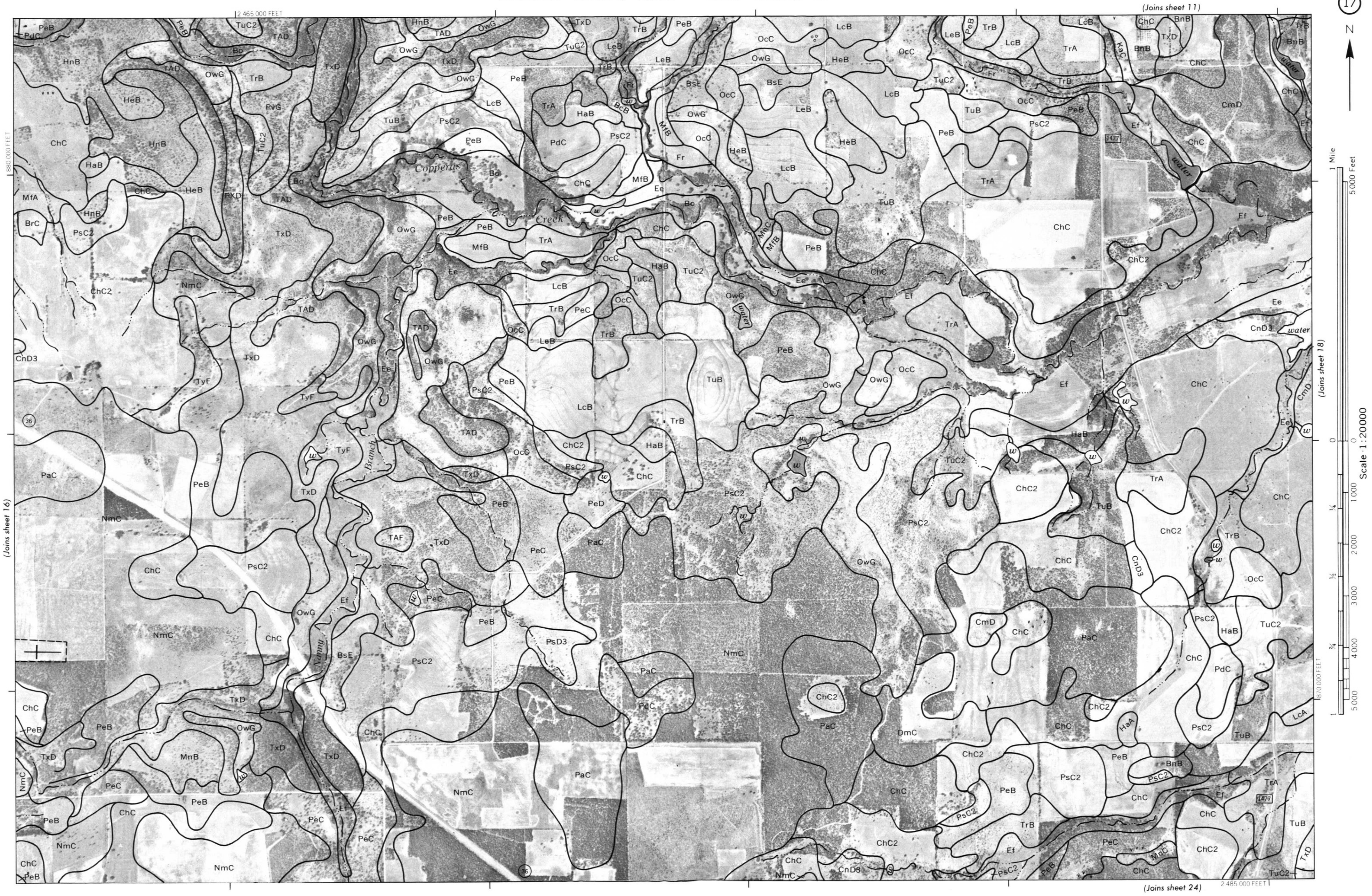
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 16

COMANCHE COUNTY, TEXAS — SHEET NUMBER 17

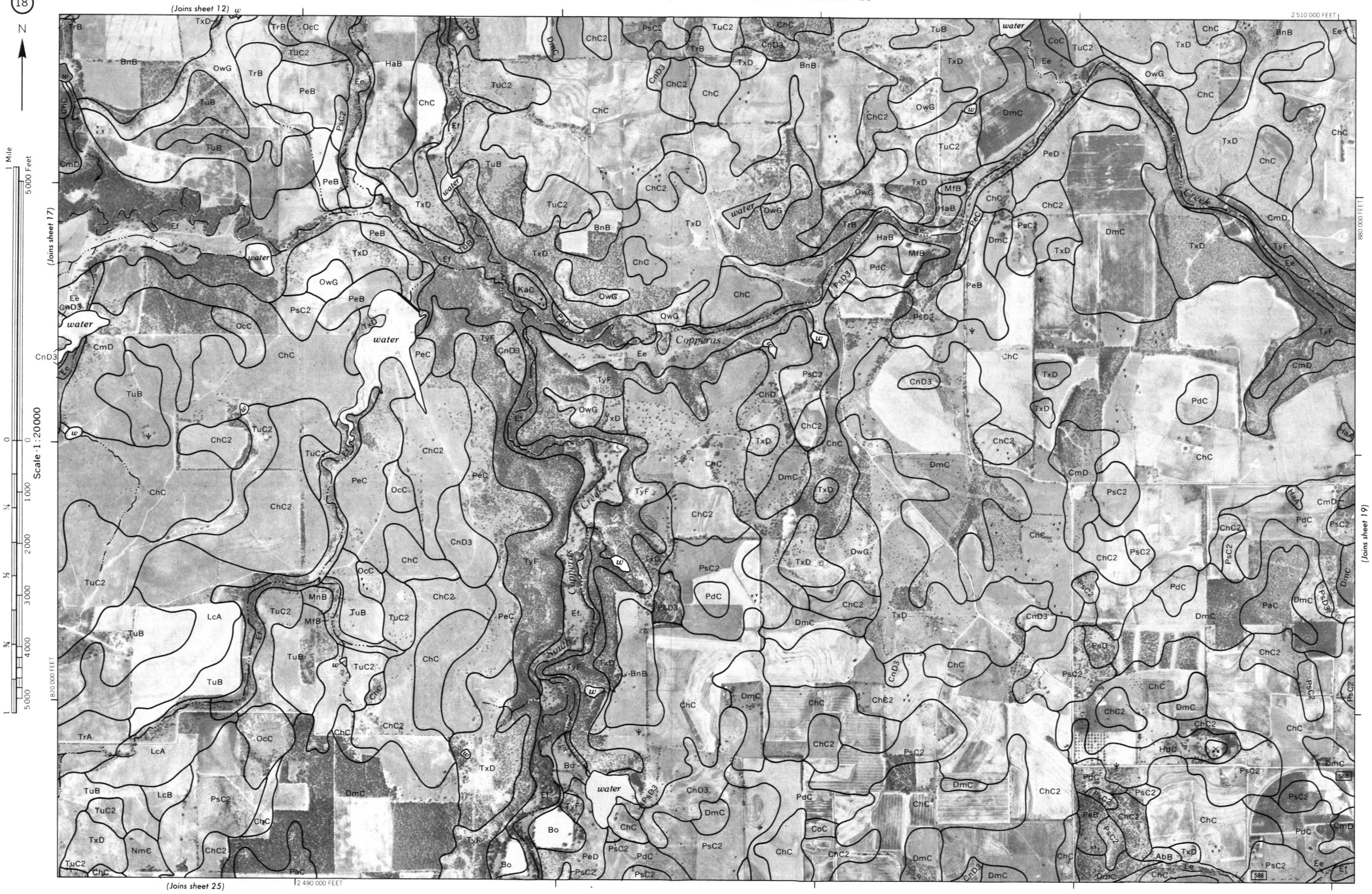
COMANCHE COUNTY, TEXAS NO. 17

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



18

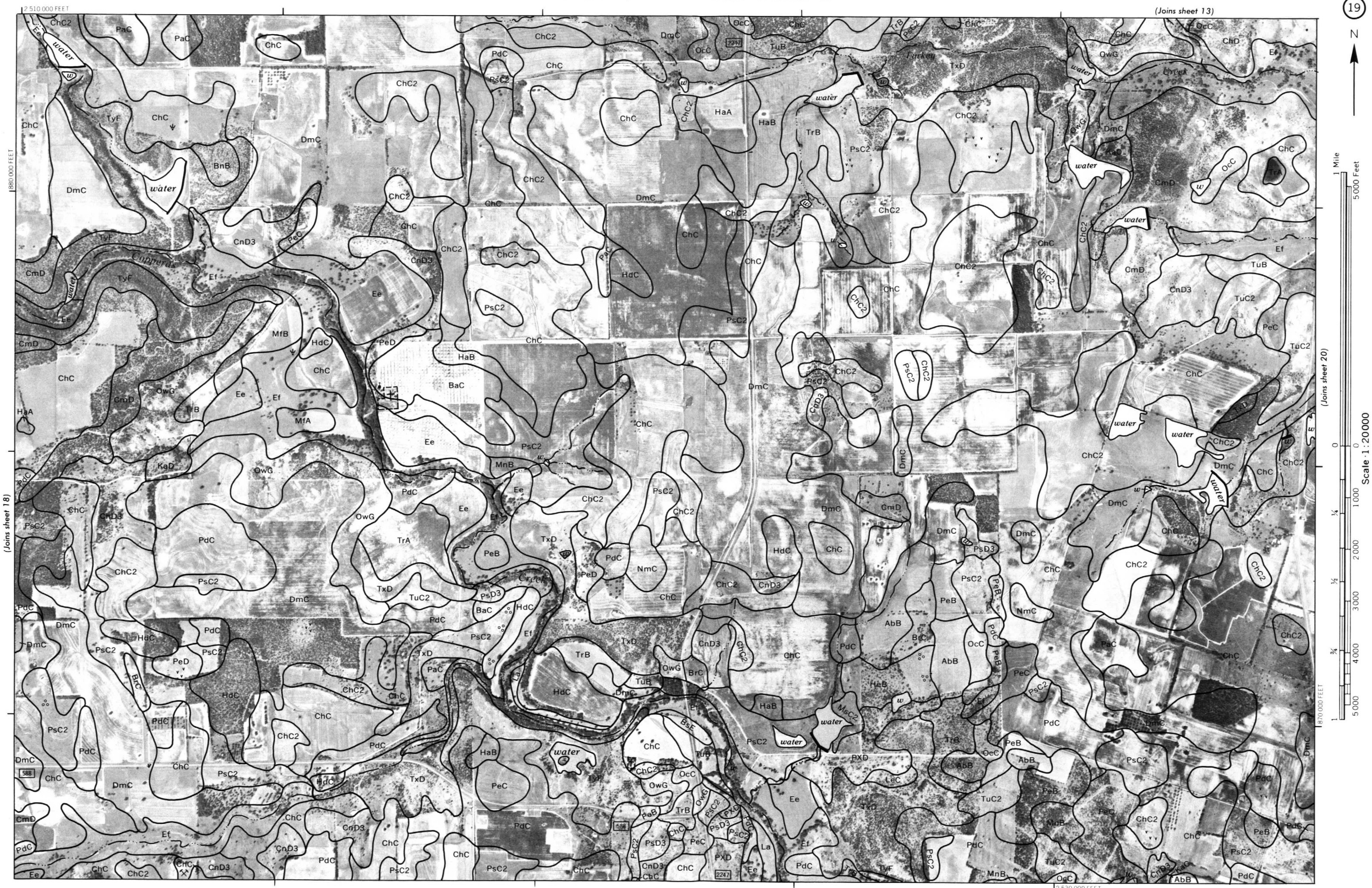
COMANCHE COUNTY, TEXAS — SHEET NUMBER 18



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 18

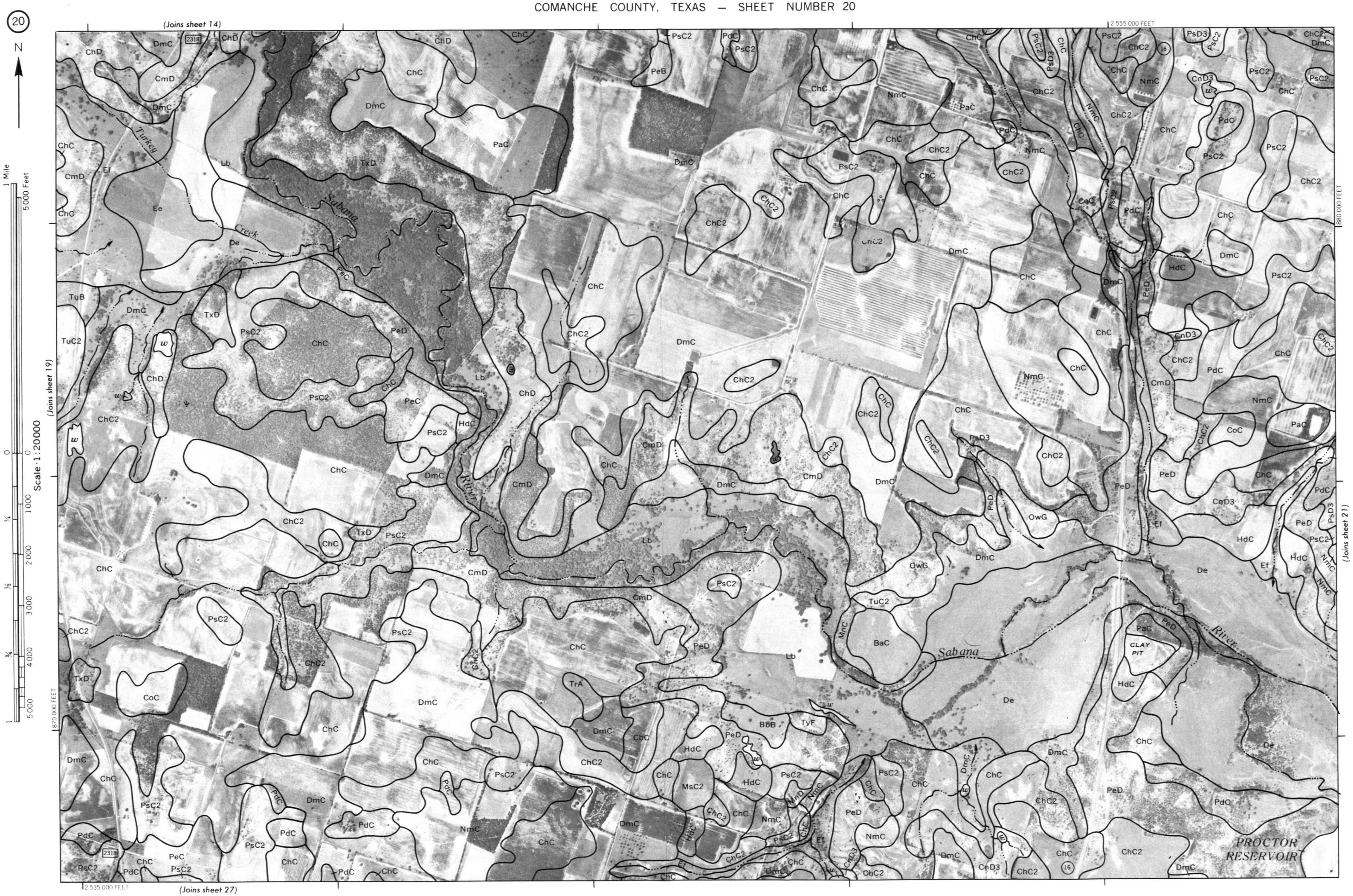
COMANCHE COUNTY, TEXAS — SHEET NUMBER 19



COMANCHE COUNTY, TEXAS NO. 19

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

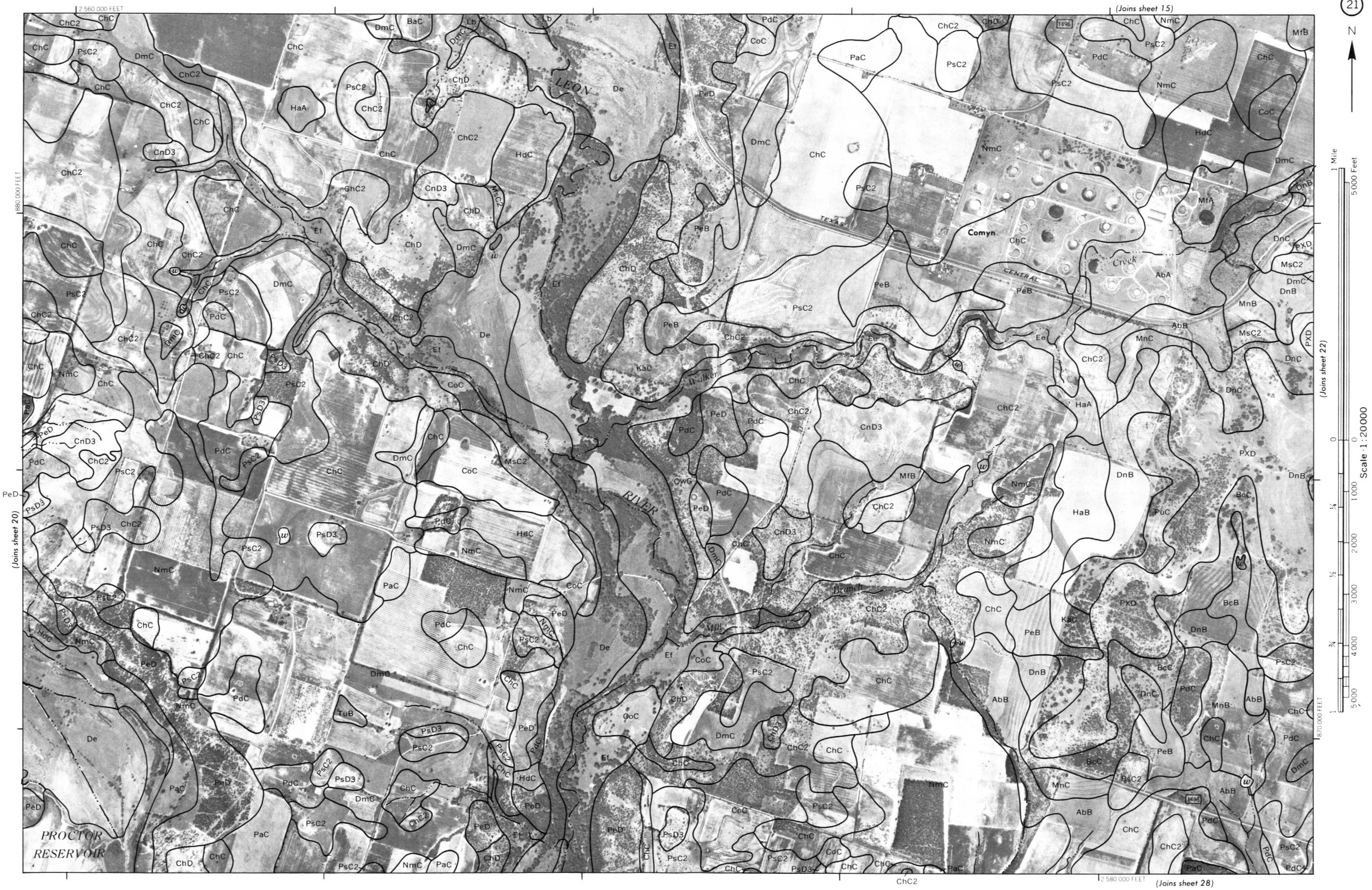
COMANCHE COUNTY, TEXAS — SHEET NUMBER 20



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 20

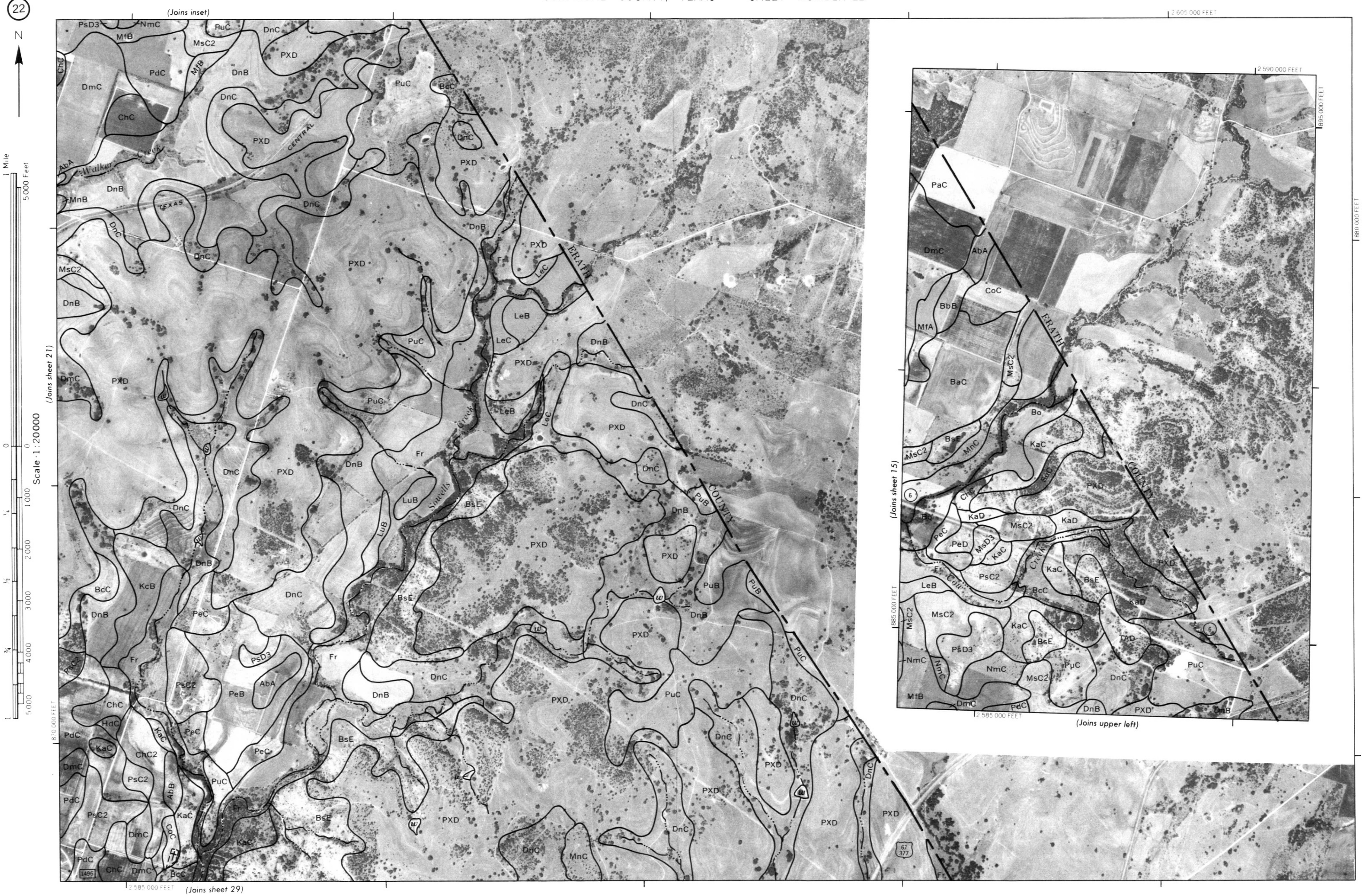
COMANCHE COUNTY, TEXAS — SHEET NUMBER 21



COMANCHE COUNTY, TEXAS NO. 21

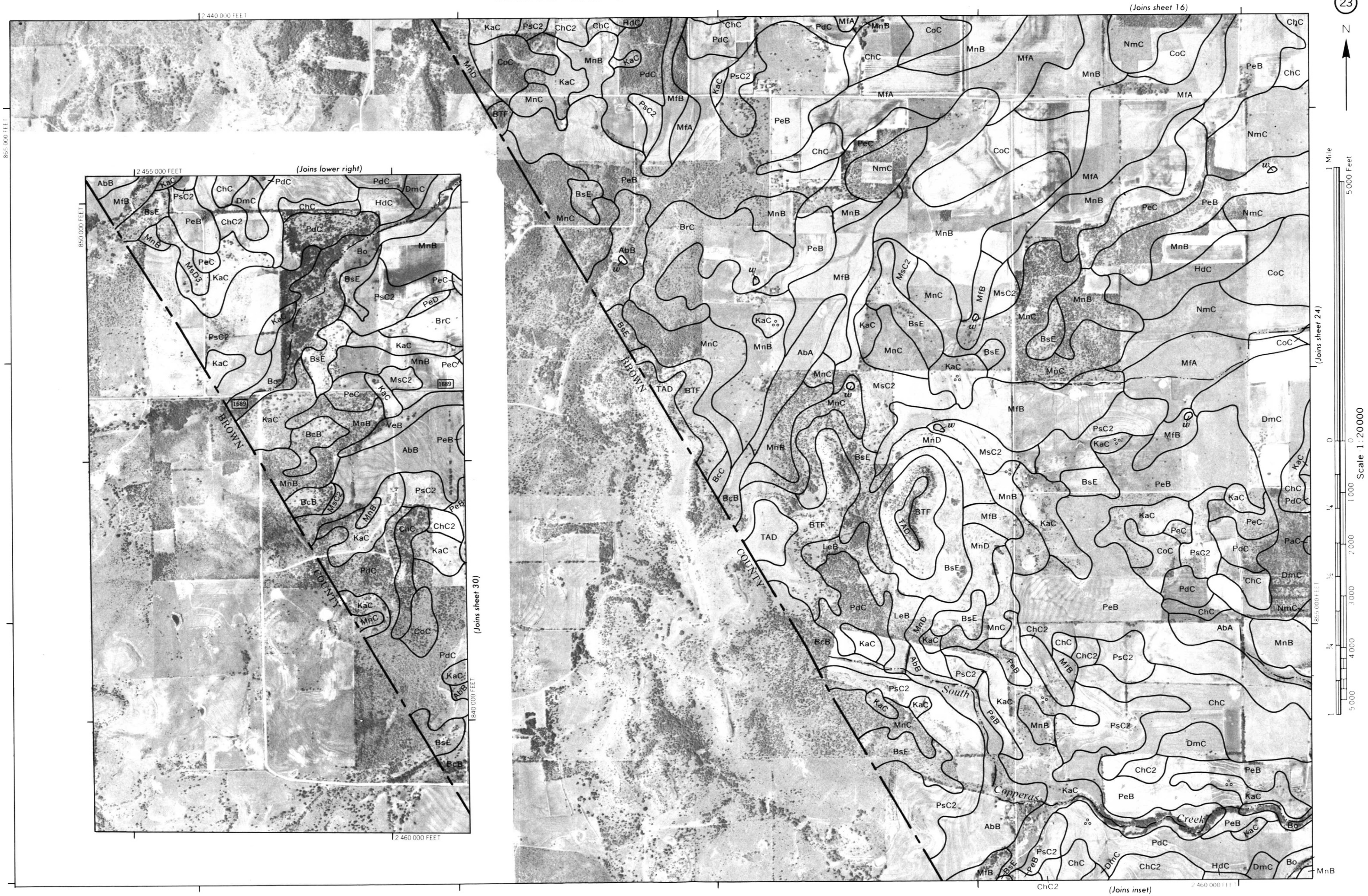
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS — SHEET NUMBER 22



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

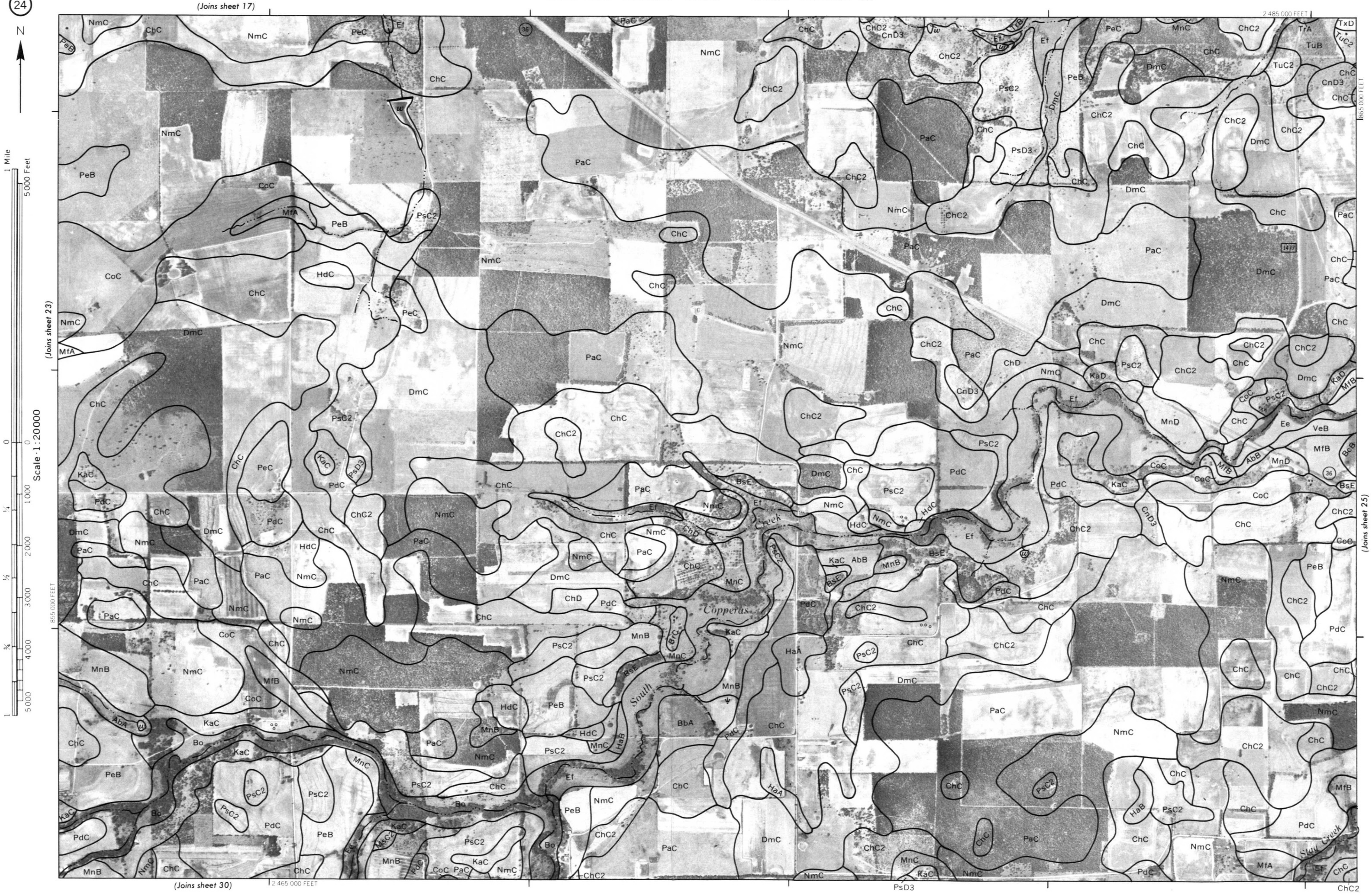
COMANCHE COUNTY, TEXAS NO. 22



COMANCHE COUNTY, TEXAS NO. 23

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS — SHEET NUMBER 24

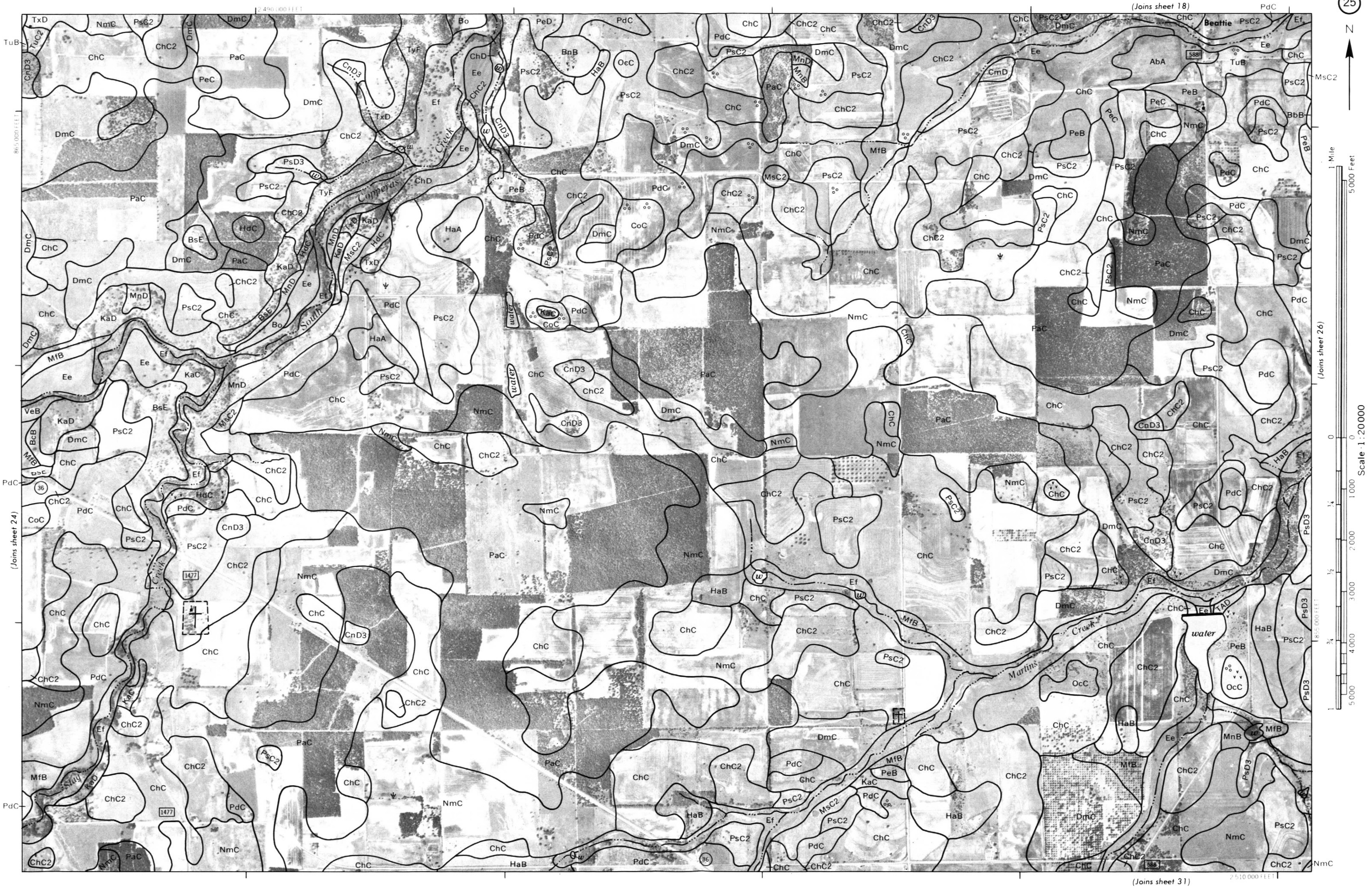


This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 24

COMANCHE COUNTY, TEXAS — SHEET NUMBER 25

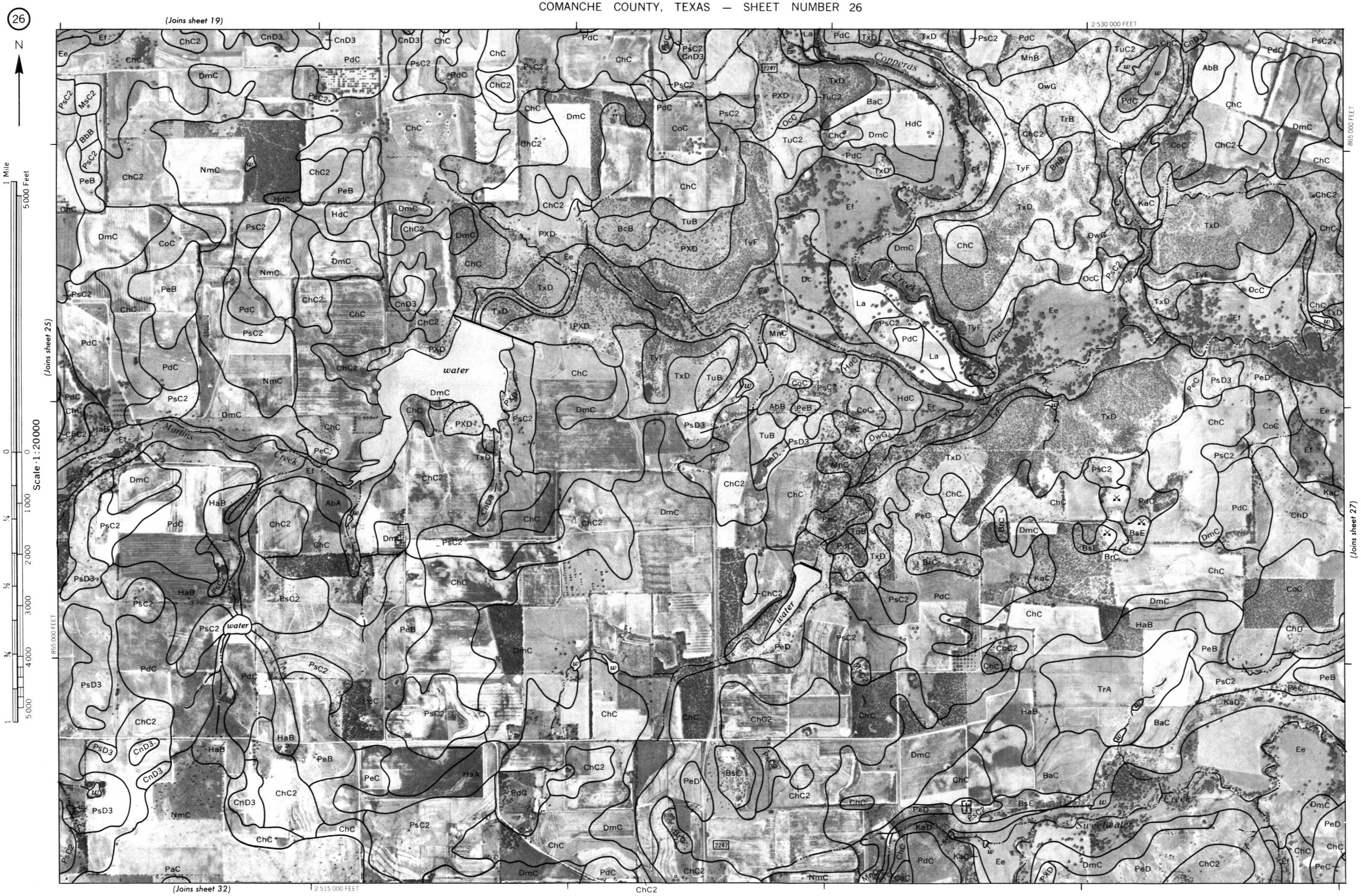
㉕



COMANCHE COUNTY, TEXAS NO. 25

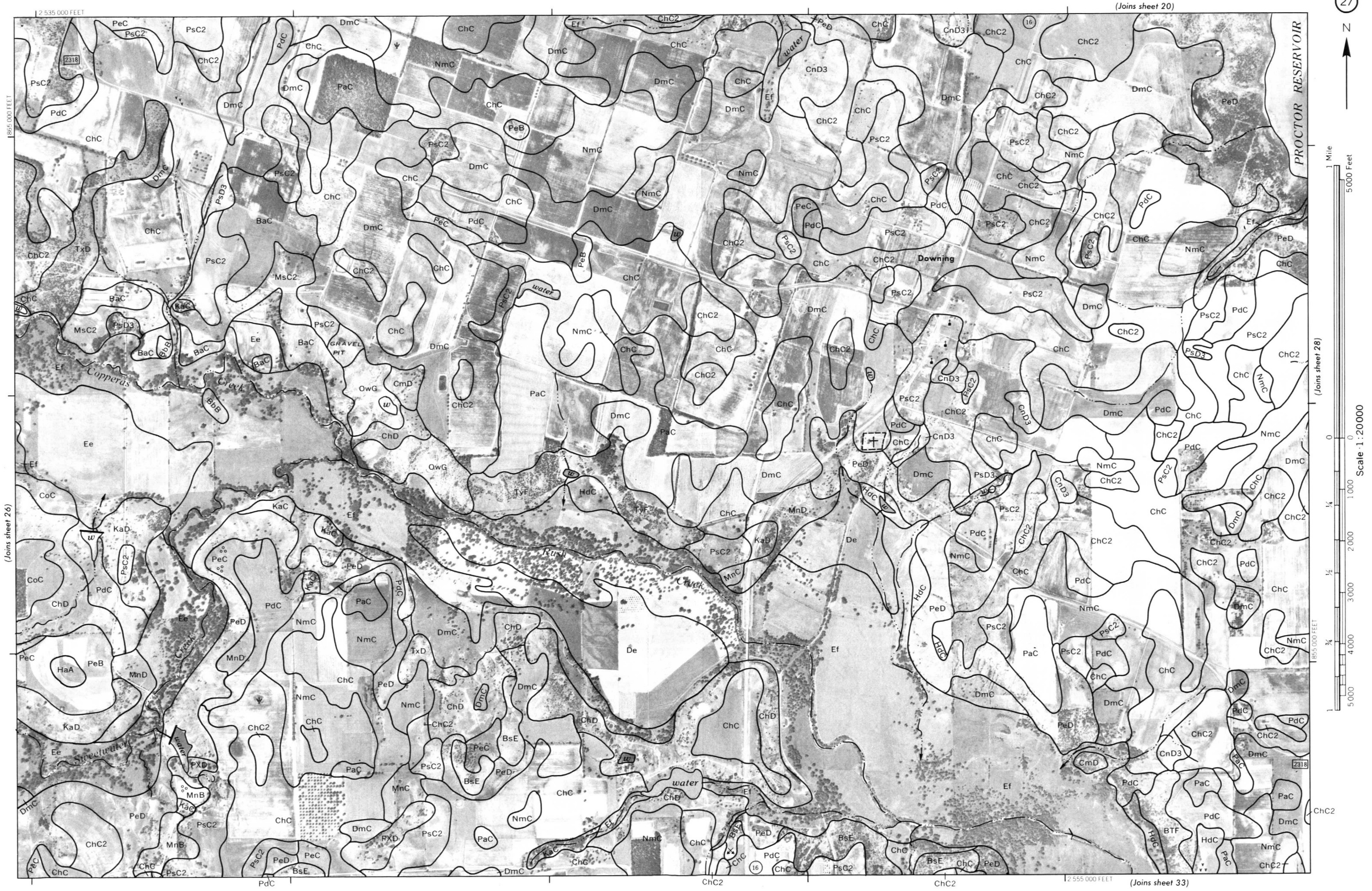
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS — SHEET NUMBER 26



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 26

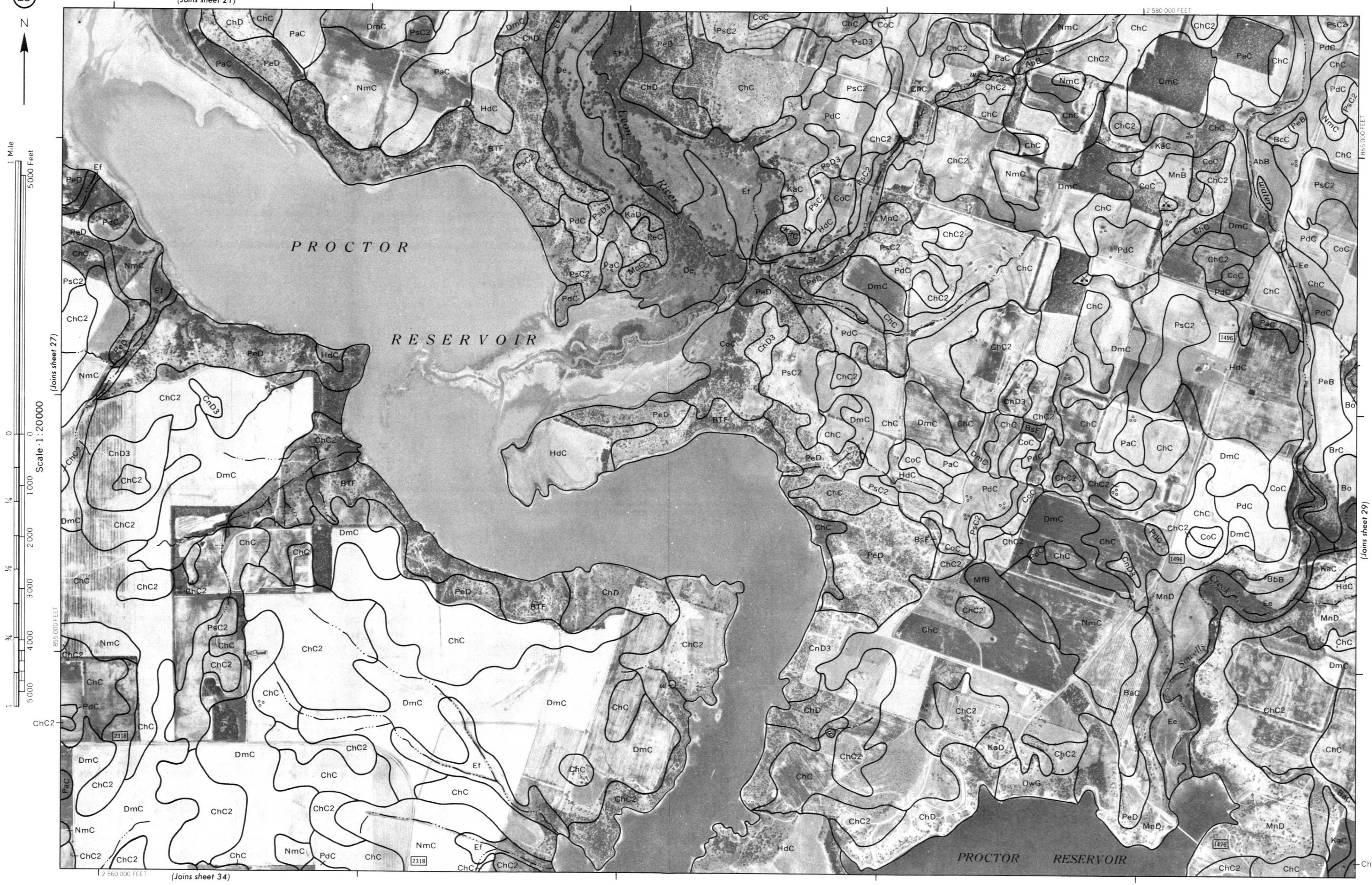


COMANCHE COUNTY, TEXAS NO. 27

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

㉘

COMANCHE COUNTY, TEXAS — SHEET NUMBER 28

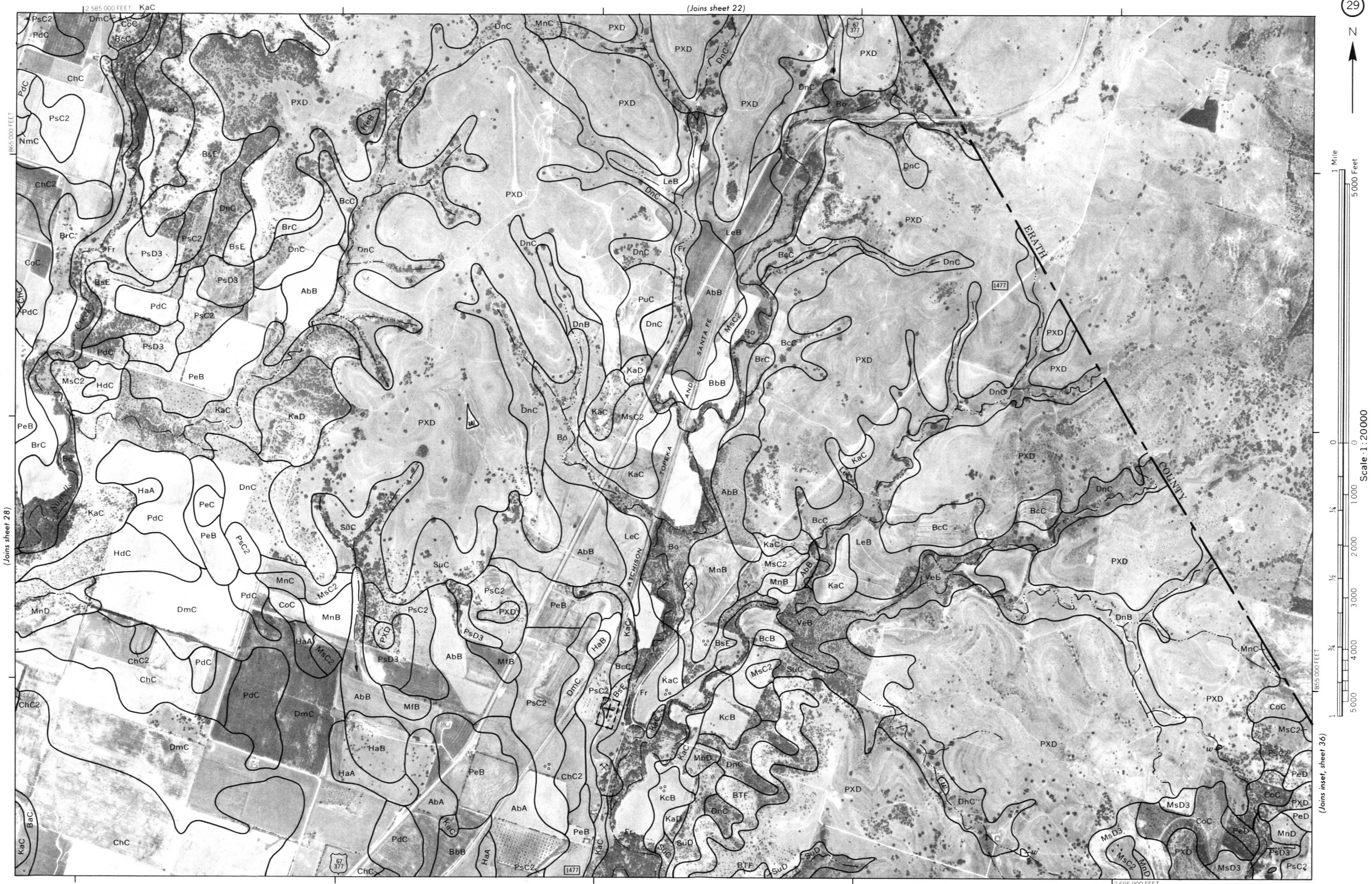


This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 28

COMANCHE COUNTY, TEXAS — SHEET NUMBER 29

(Joins sheet 22)



(Joins sheet 28)

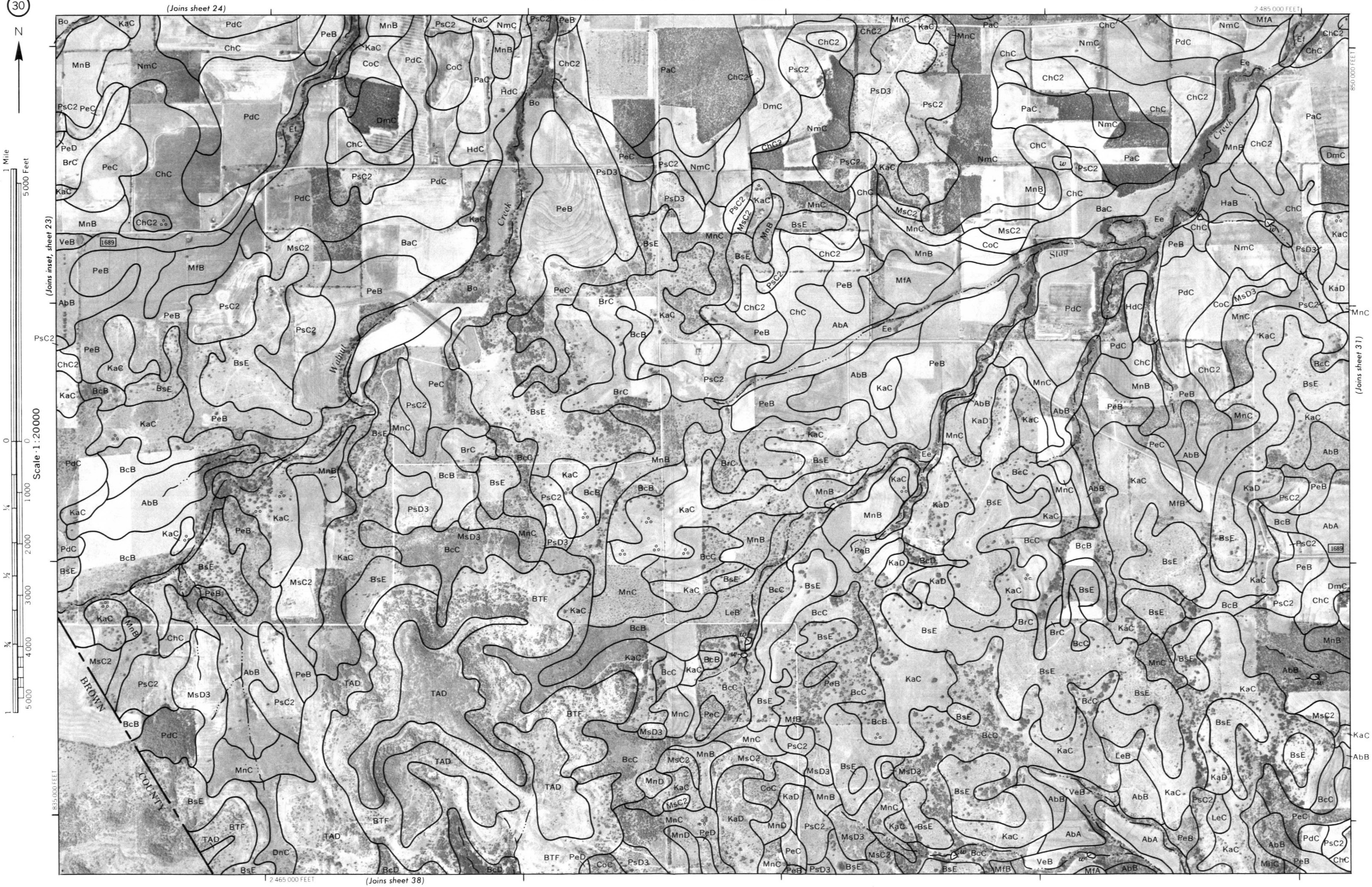
(Joins inset, sheet 36)

(Joins sheet 35)

COMANCHE COUNTY, TEXAS NO. 29

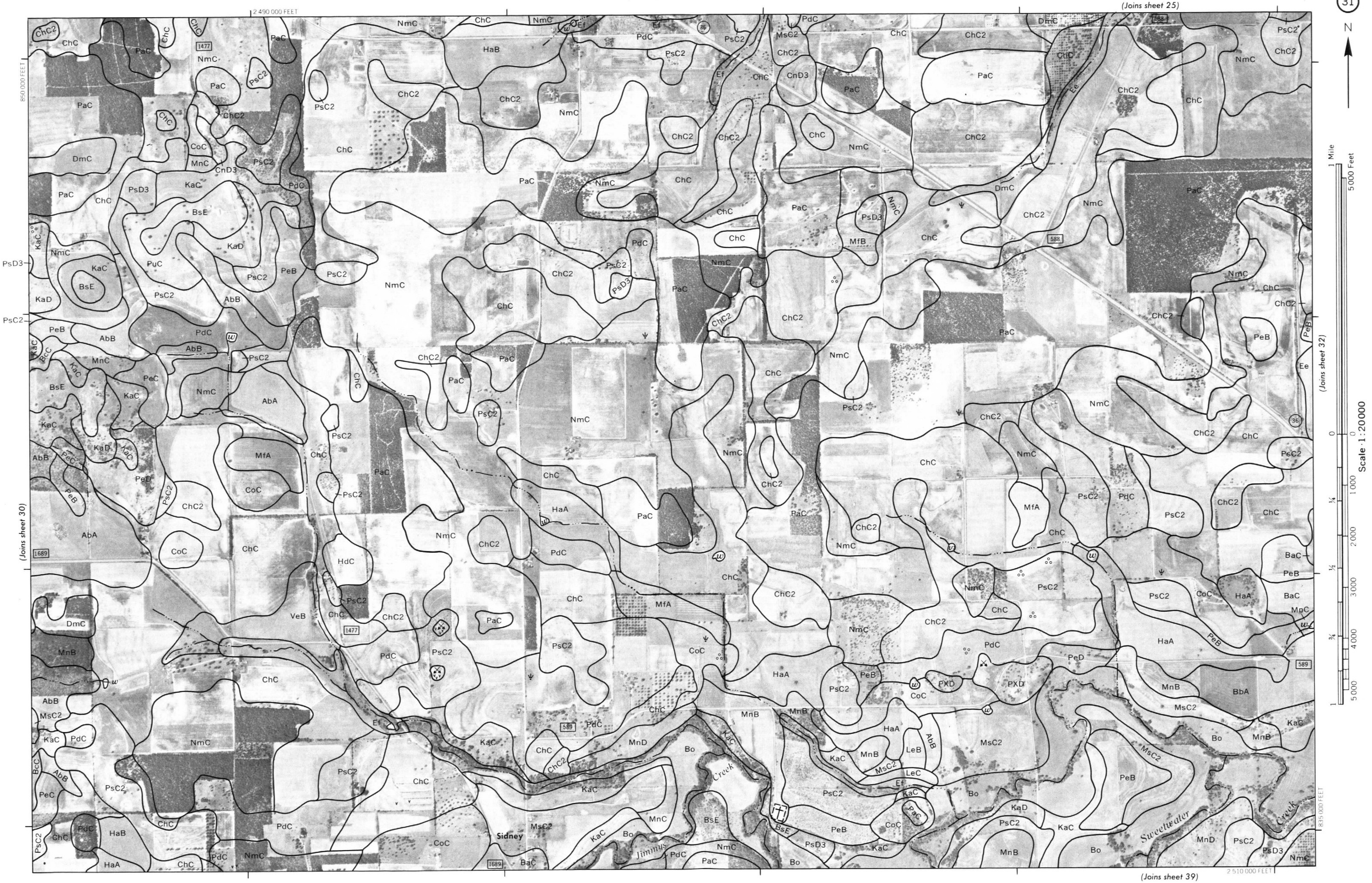
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS — SHEET NUMBER 30



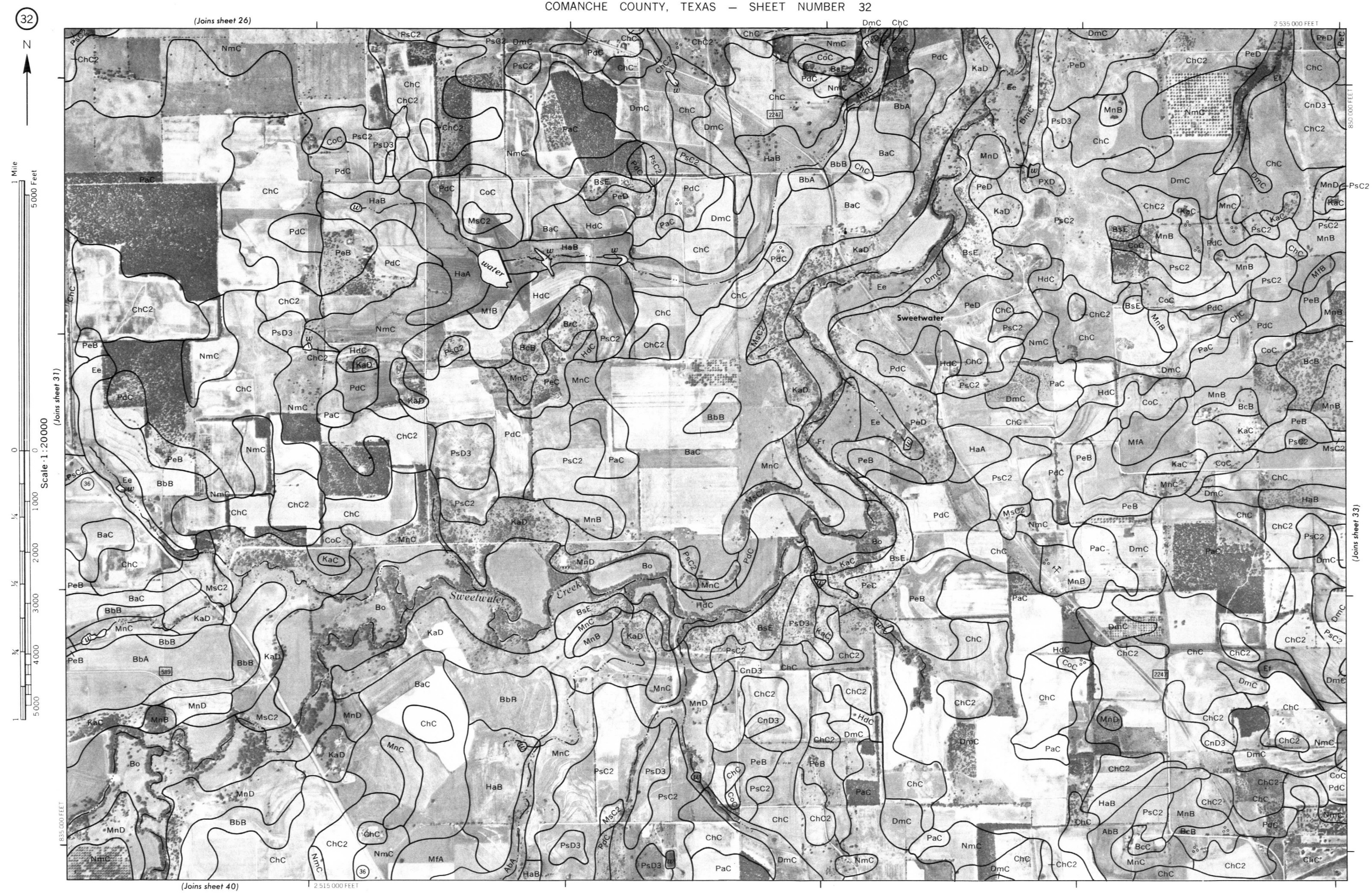
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS — SHEET NUMBER 31



COMANCHE COUNTY, TEXAS NO. 31
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

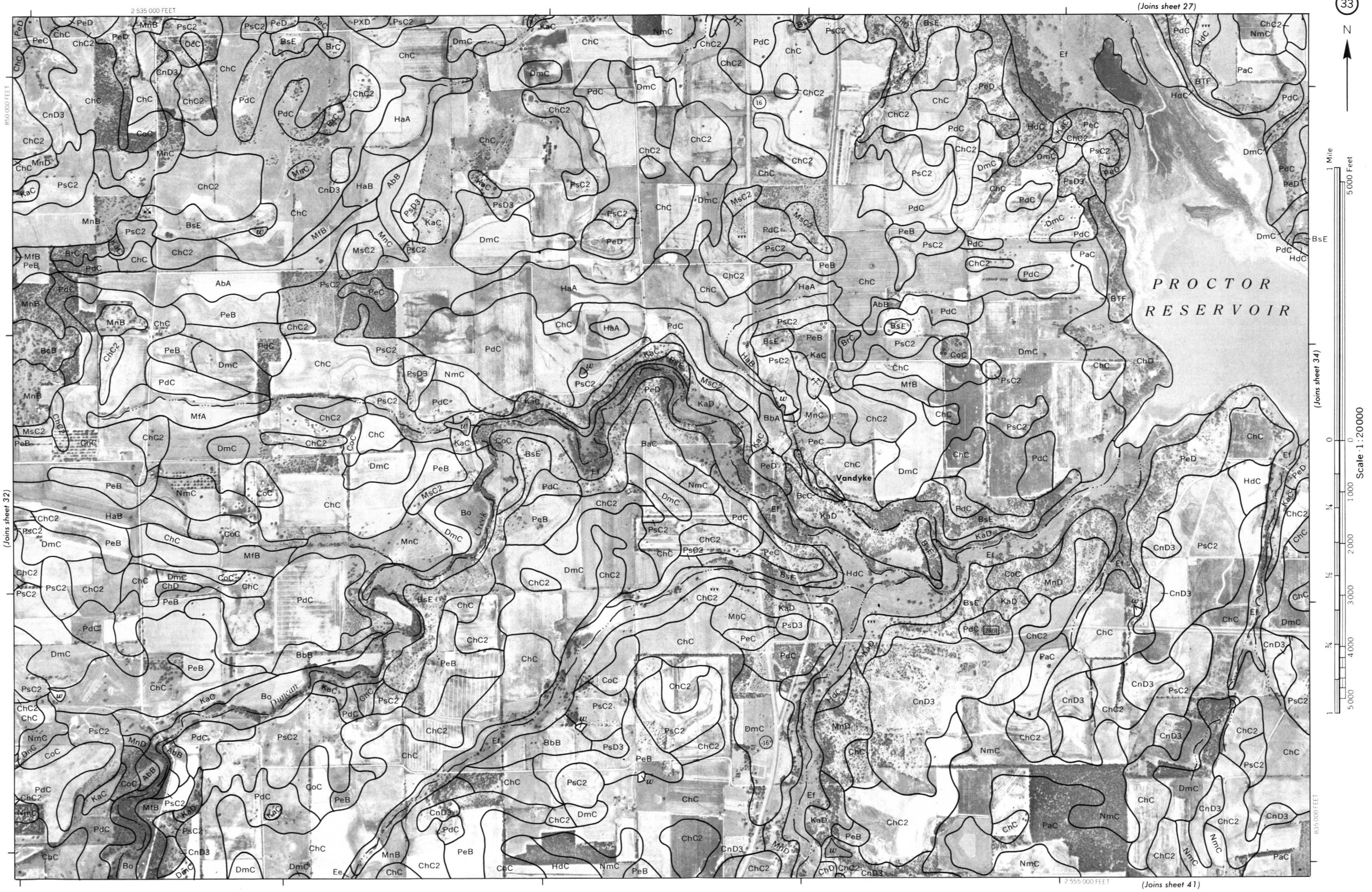
COMANCHE COUNTY, TEXAS — SHEET NUMBER 32



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 32

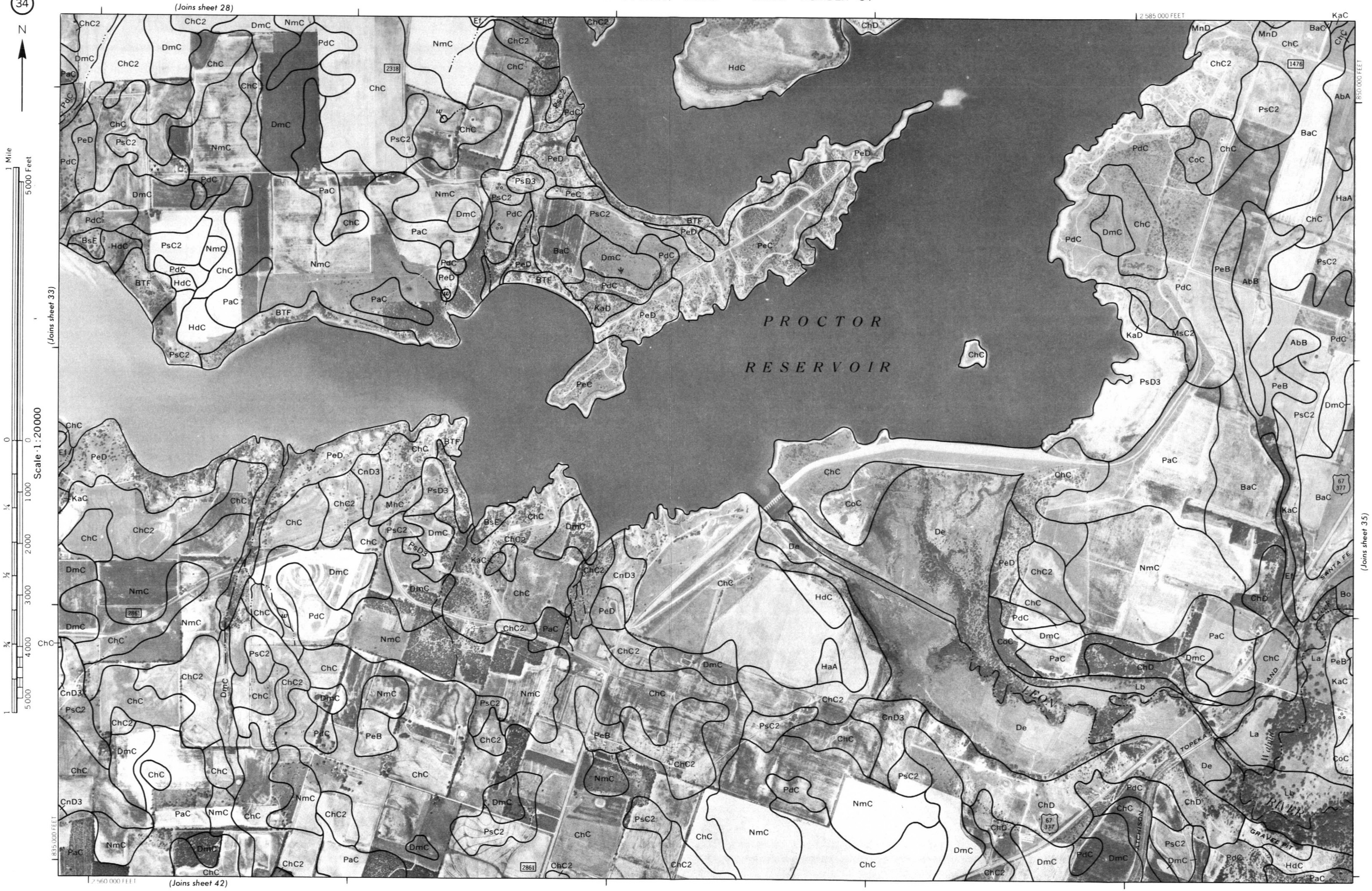
COMANCHE COUNTY, TEXAS — SHEET NUMBER 33



COMANCHE COUNTY, TEXAS NO. 33

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS — SHEET NUMBER 34



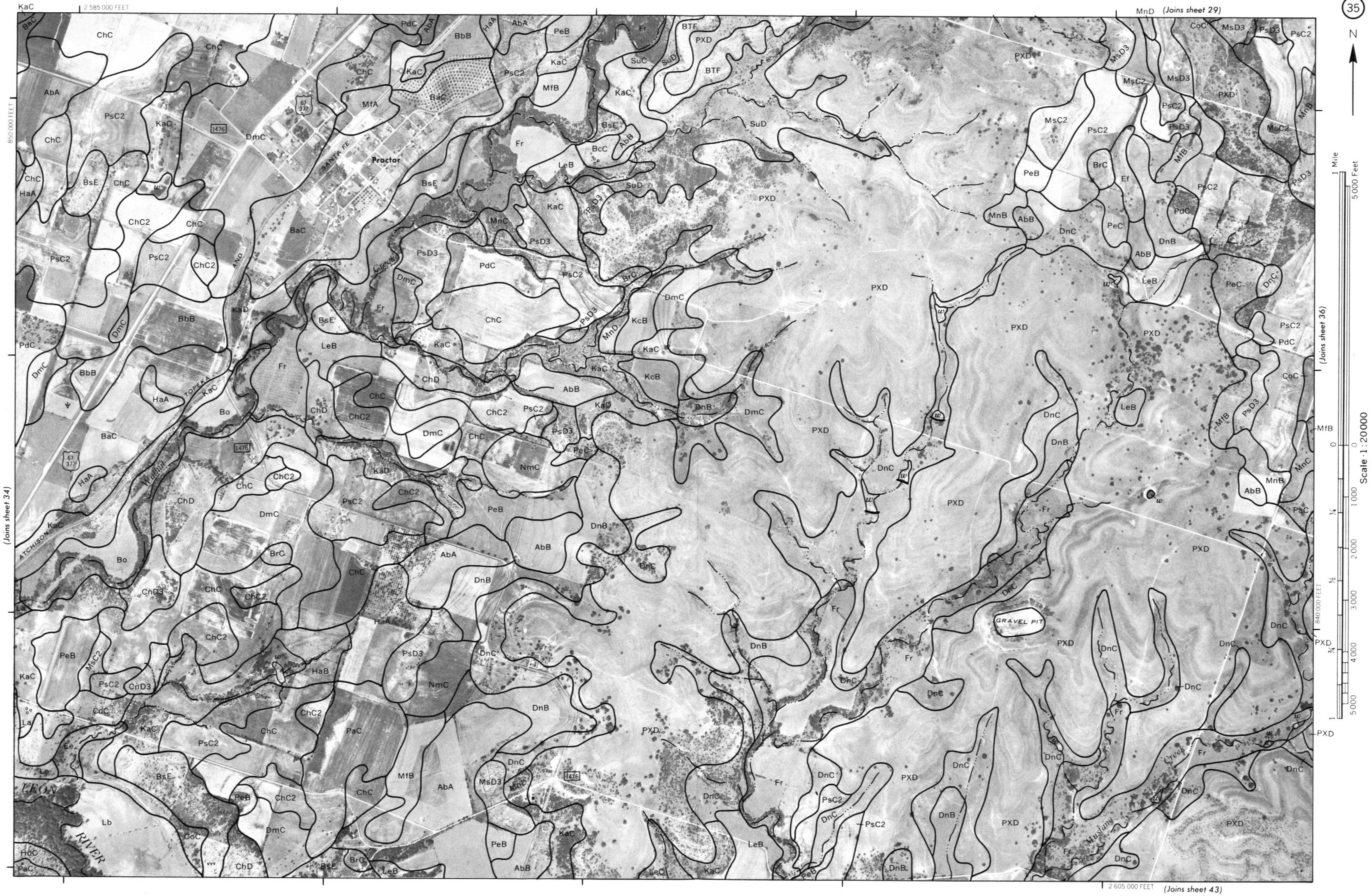
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 34

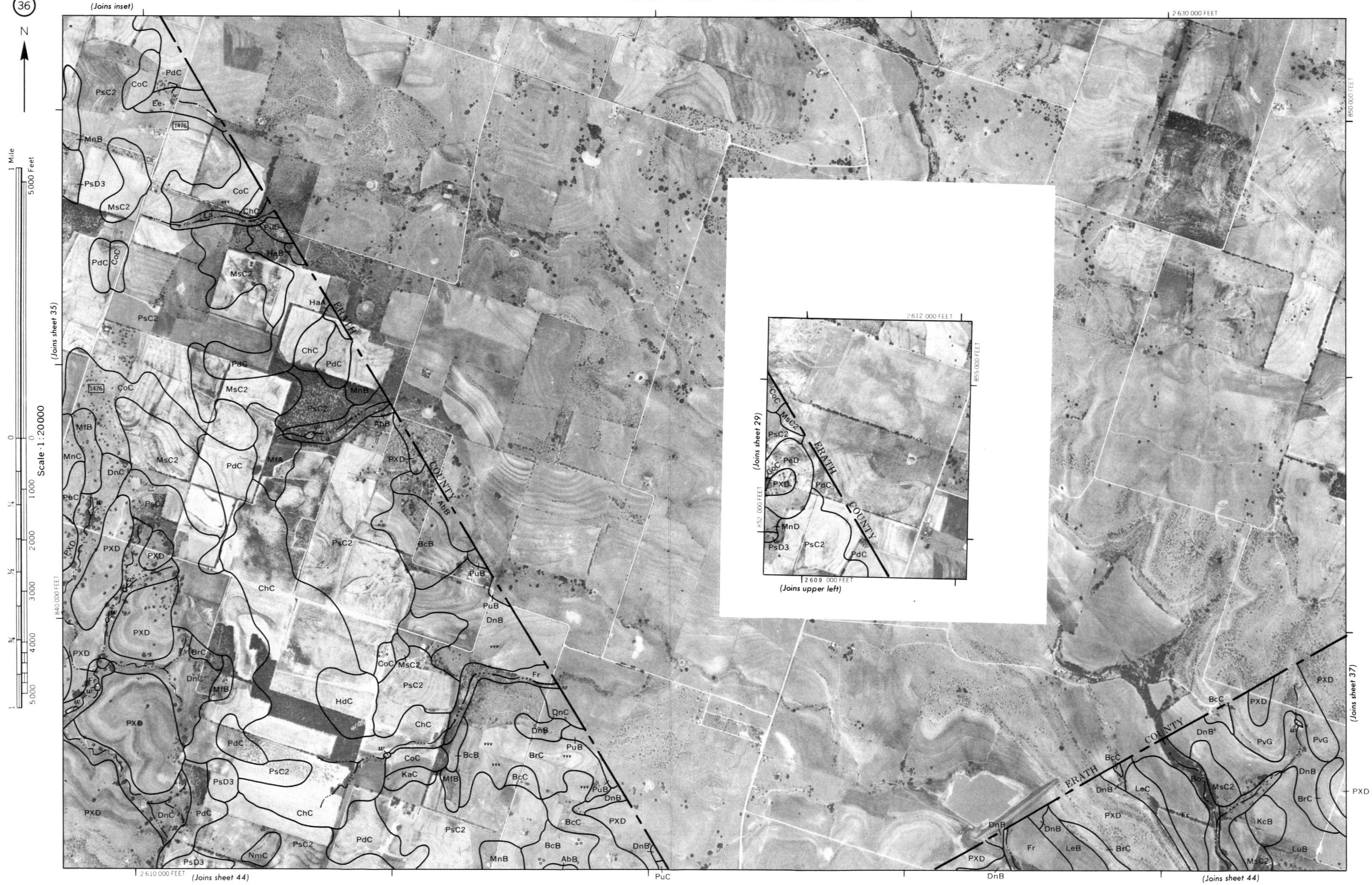
COMANCHE COUNTY, TEXAS — SHEET NUMBER 35

COMANCHE COUNTY, TEXAS NO. 35

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



COMANCHE COUNTY, TEXAS — SHEET NUMBER 36



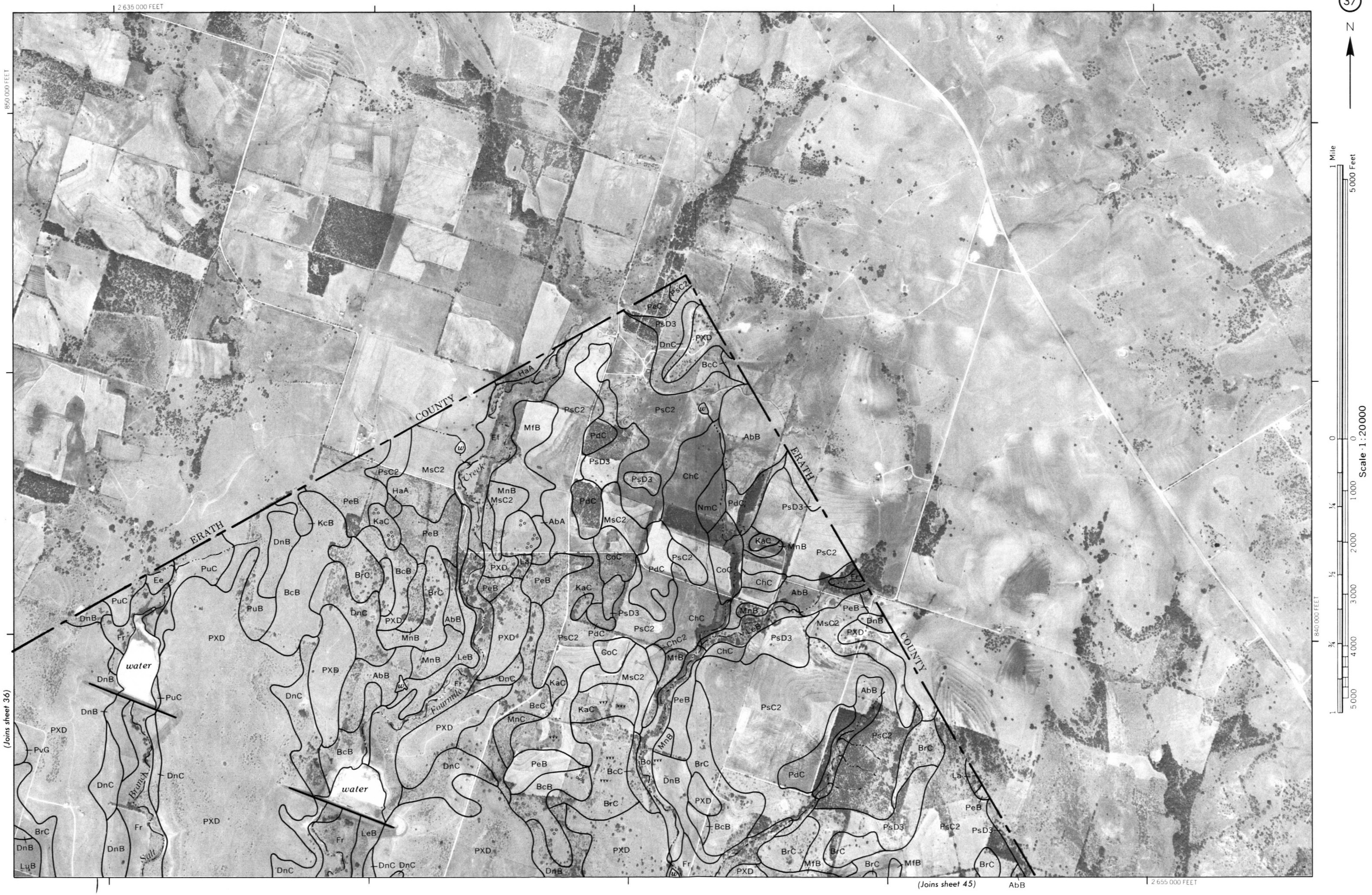
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 36

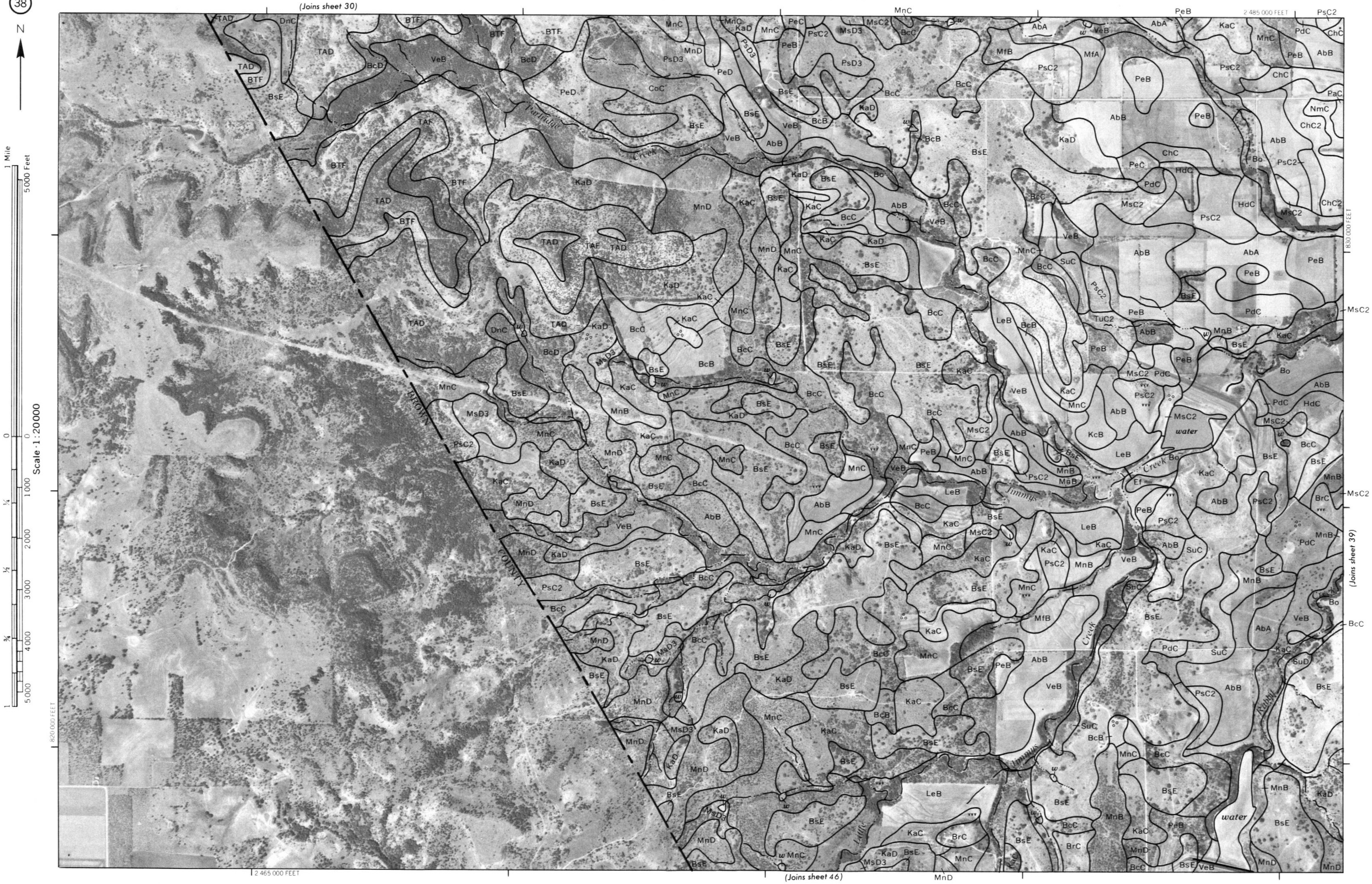
COMANCHE COUNTY, TEXAS — SHEET NUMBER 37

COMANCHE COUNTY, TEXAS NO. 37

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



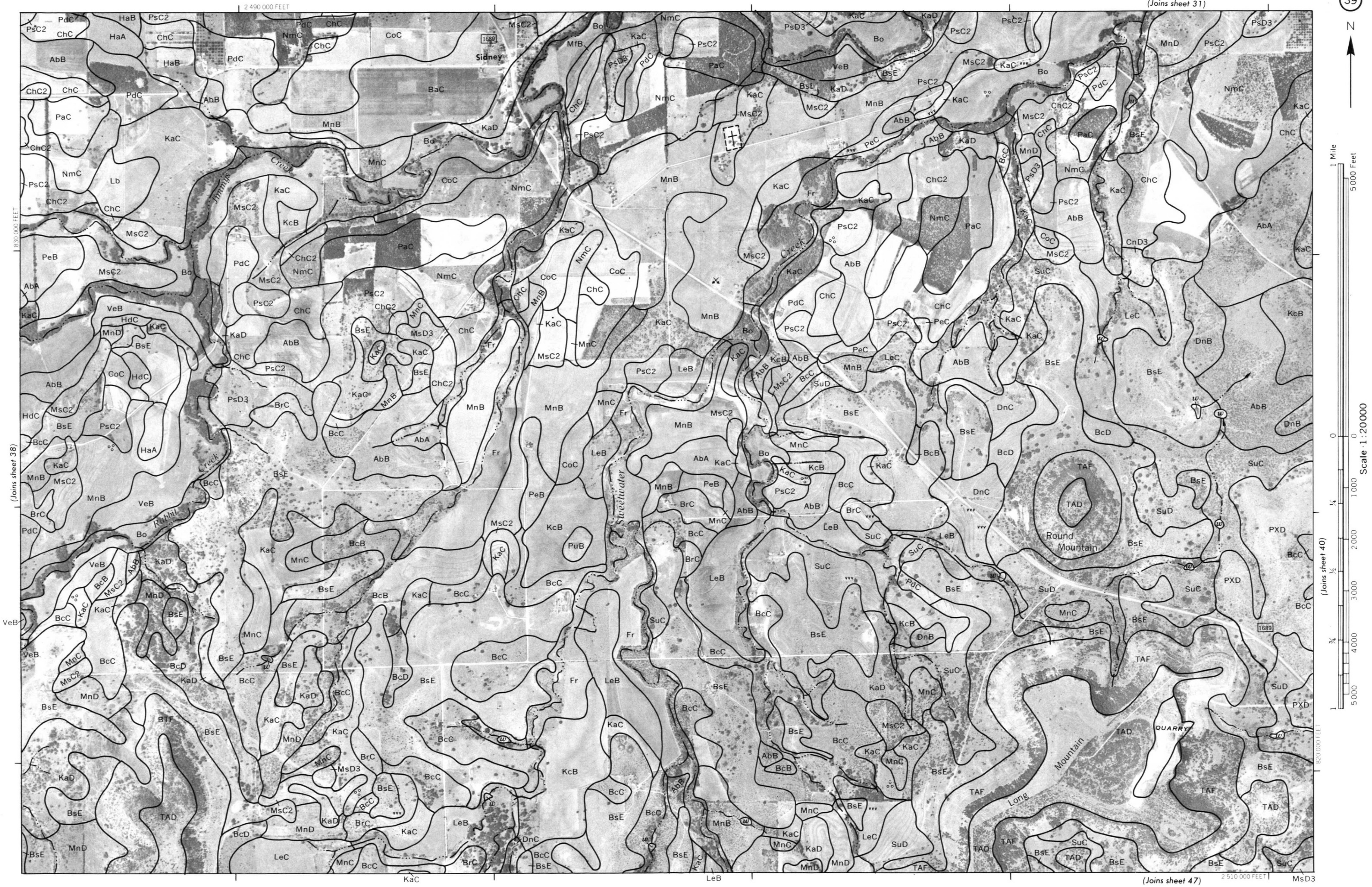
COMANCHE COUNTY, TEXAS — SHEET NUMBER 38



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 38

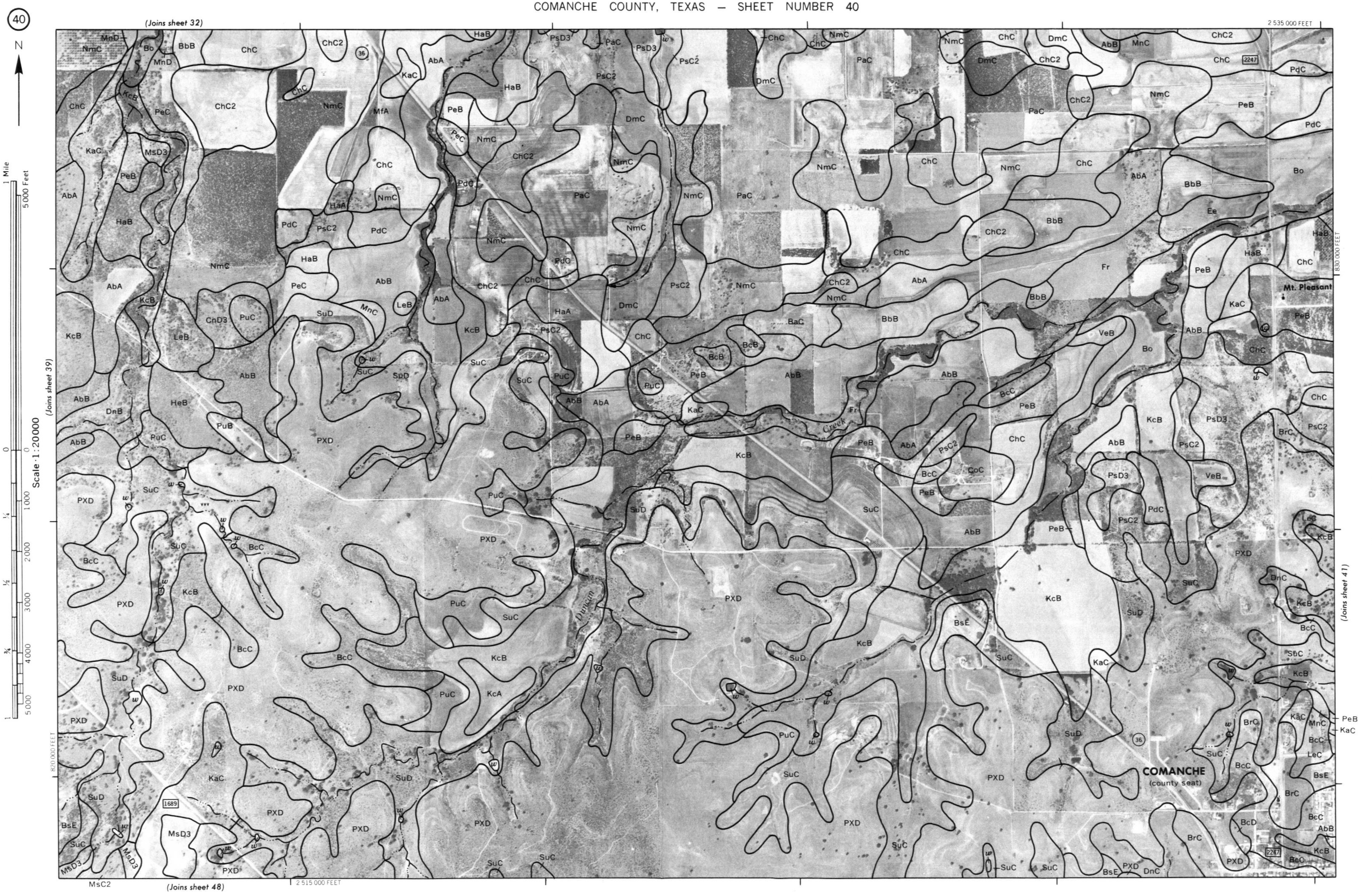
COMANCHE COUNTY, TEXAS — SHEET NUMBER 39



COMANCHE COUNTY, TEXAS NO. 39

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS — SHEET NUMBER 40



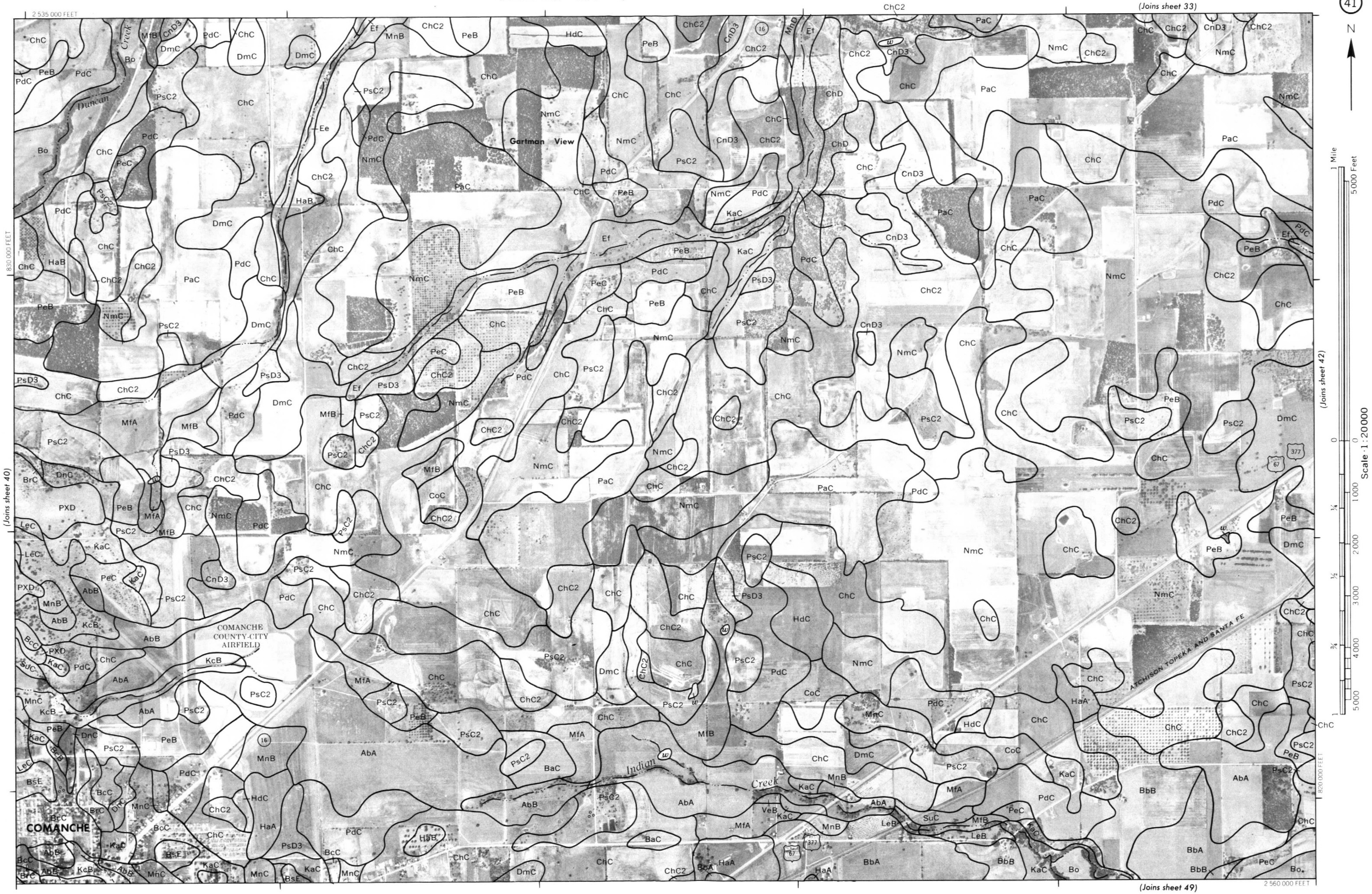
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 40

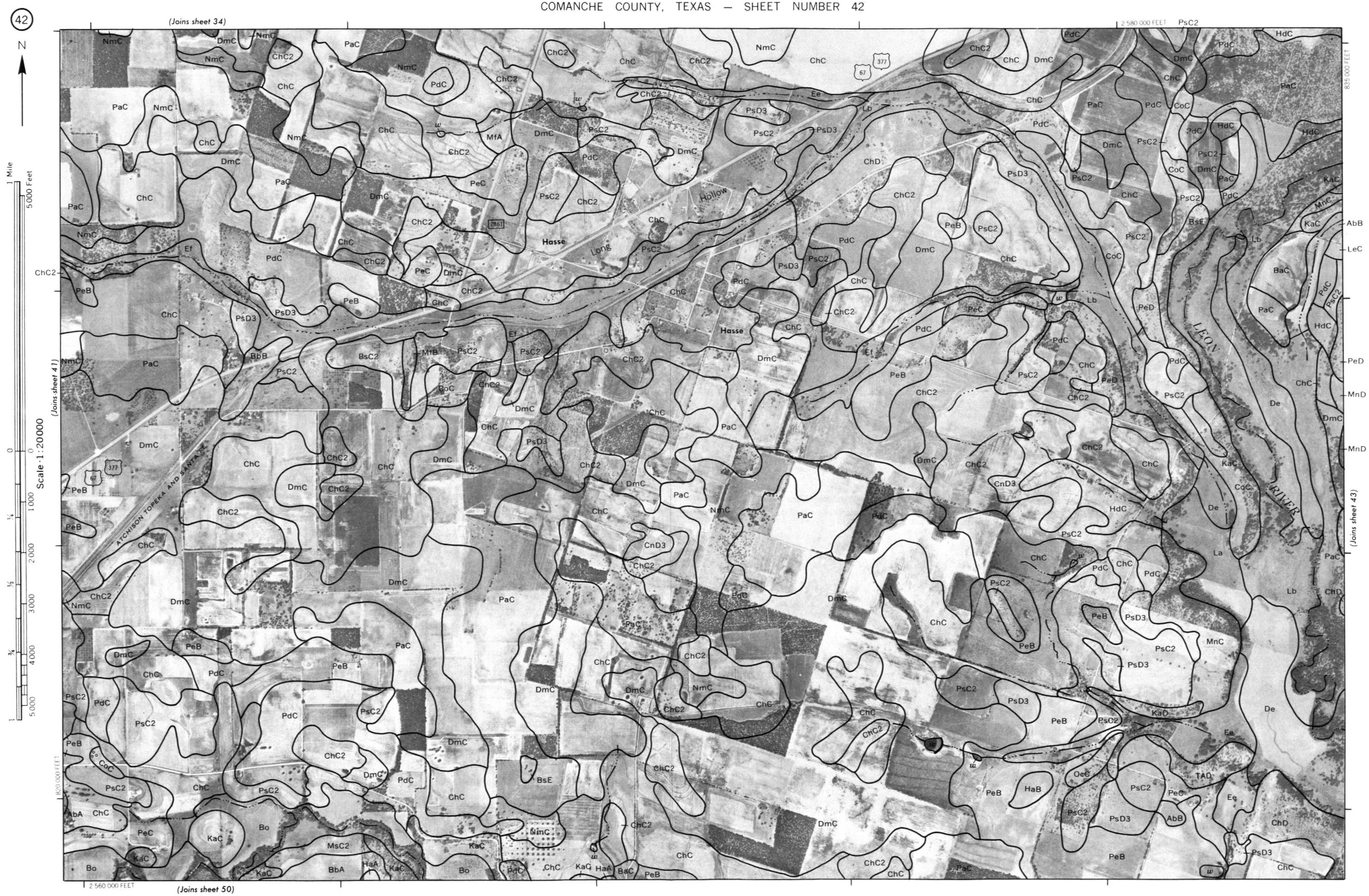
COMANCHE COUNTY, TEXAS — SHEET NUMBER 41

COMANCHE COUNTY, TEXAS NO. 41

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



COMANCHE COUNTY, TEXAS — SHEET NUMBER 42



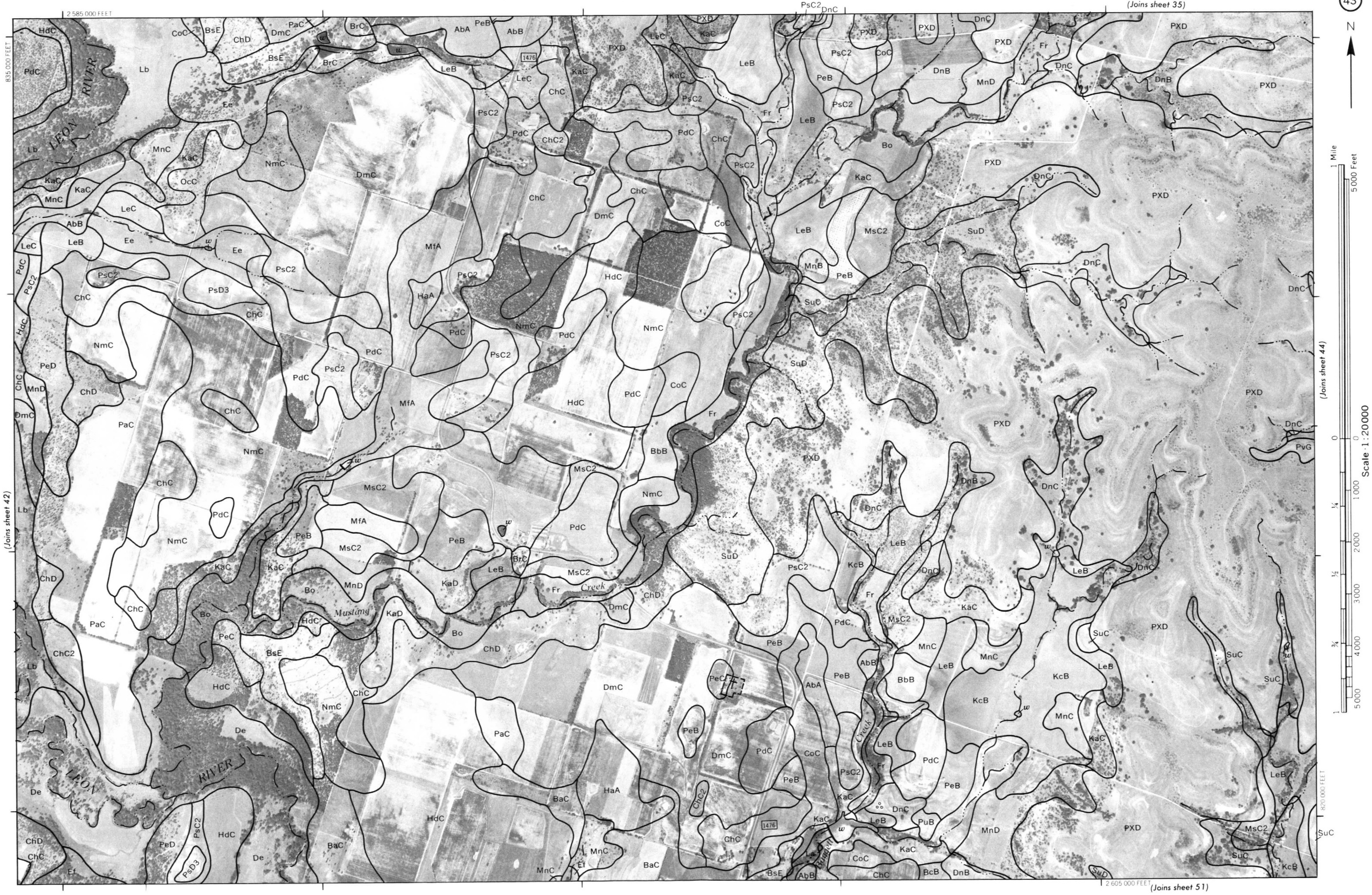
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 42

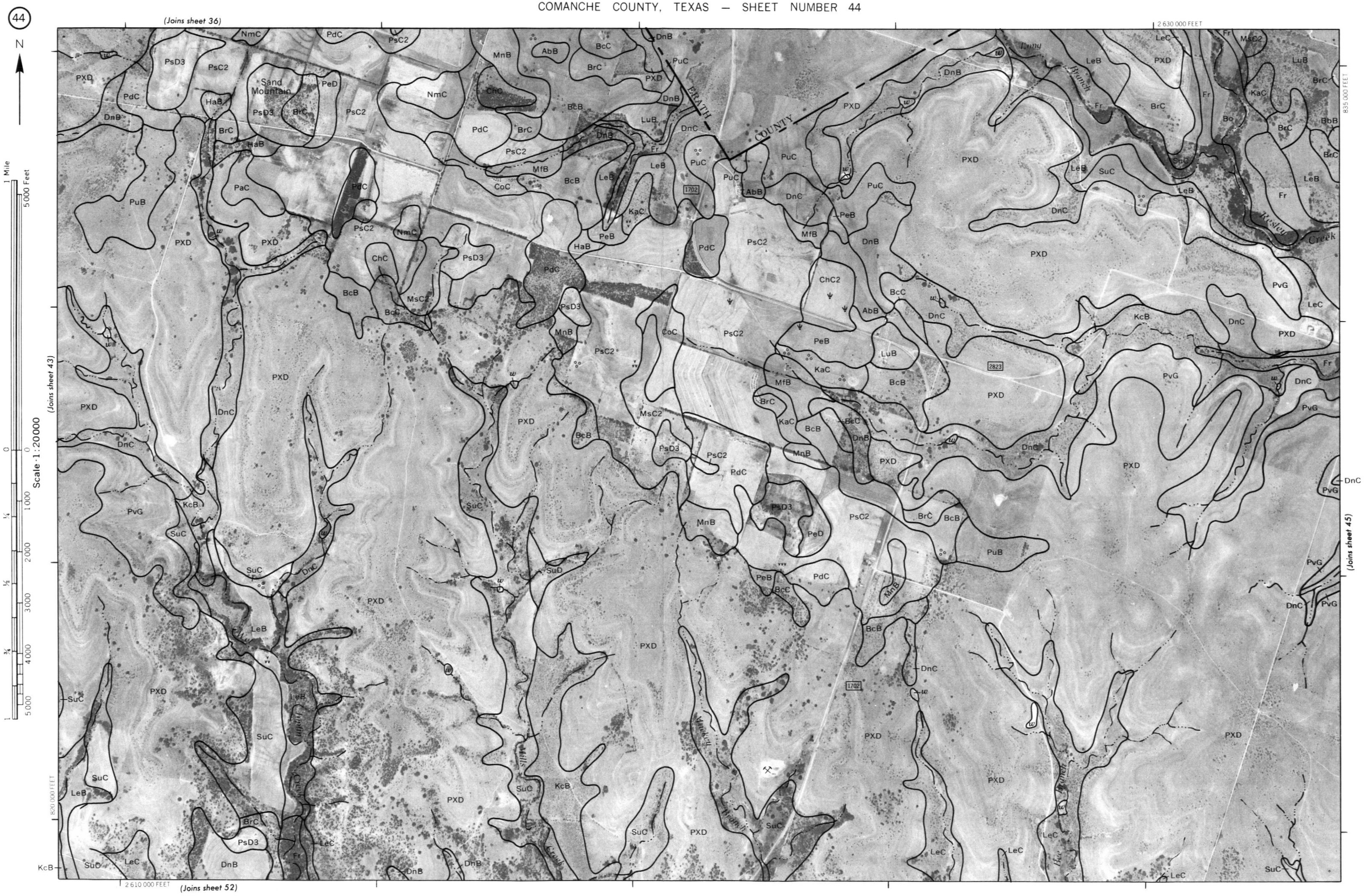
COMANCHE COUNTY, TEXAS — SHEET NUMBER 43

COMANCHE COUNTY, TEXAS NO. 43

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



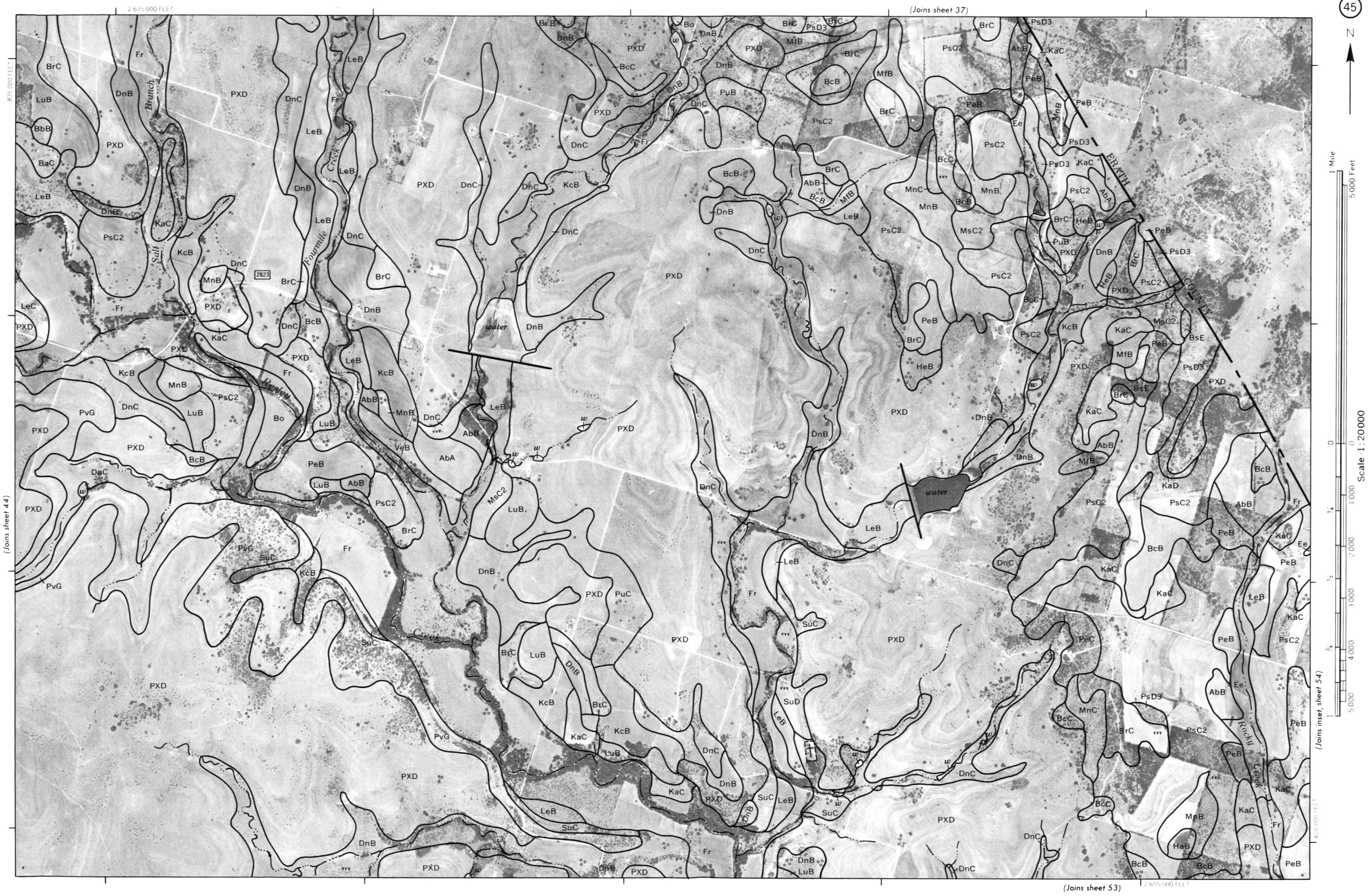
COMANCHE COUNTY, TEXAS — SHEET NUMBER 44



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 44

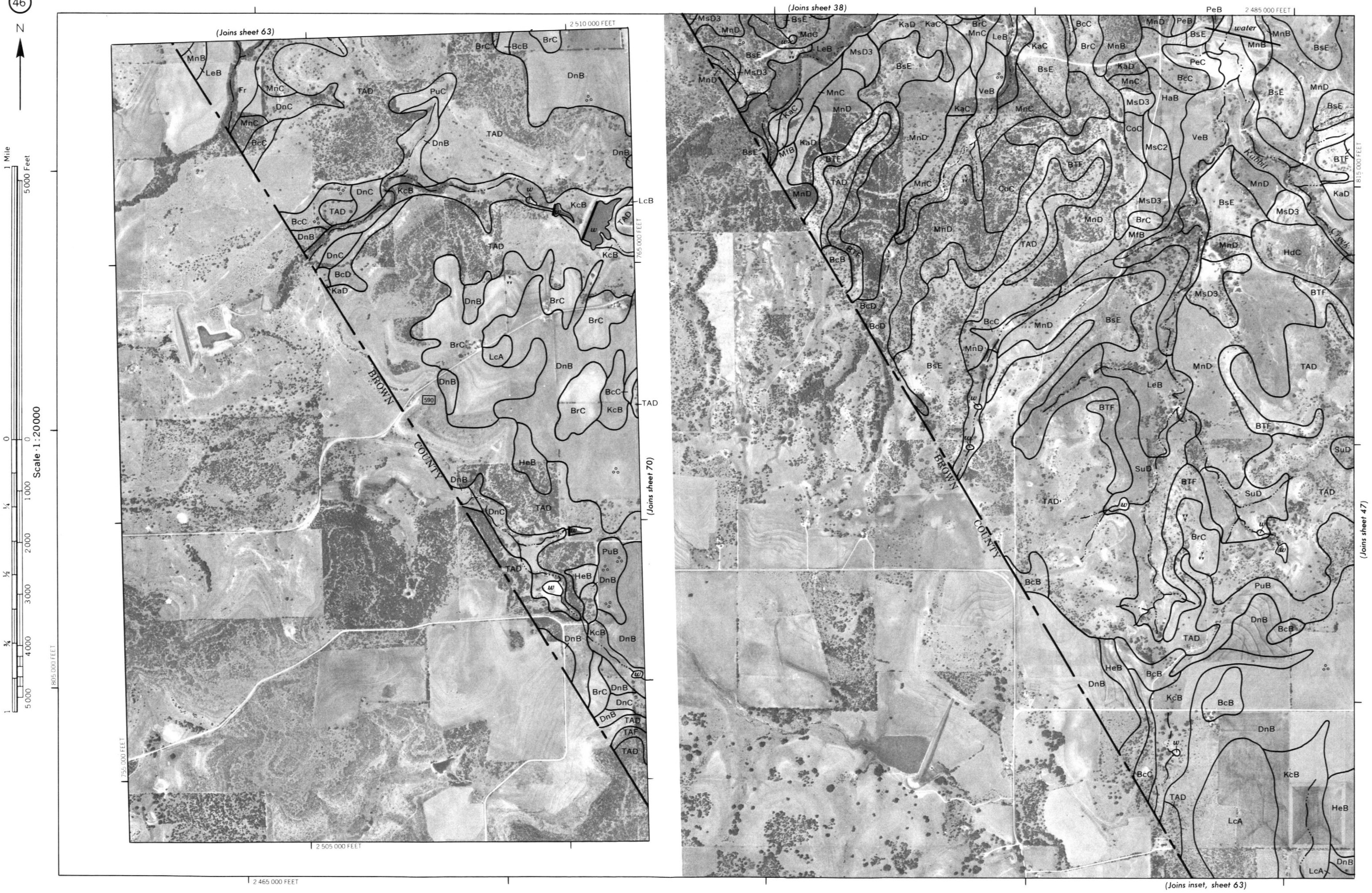
COMANCHE COUNTY, TEXAS — SHEET NUMBER 45



COMANCHE COUNTY, TEXAS NO. 45

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS — SHEET NUMBER 46

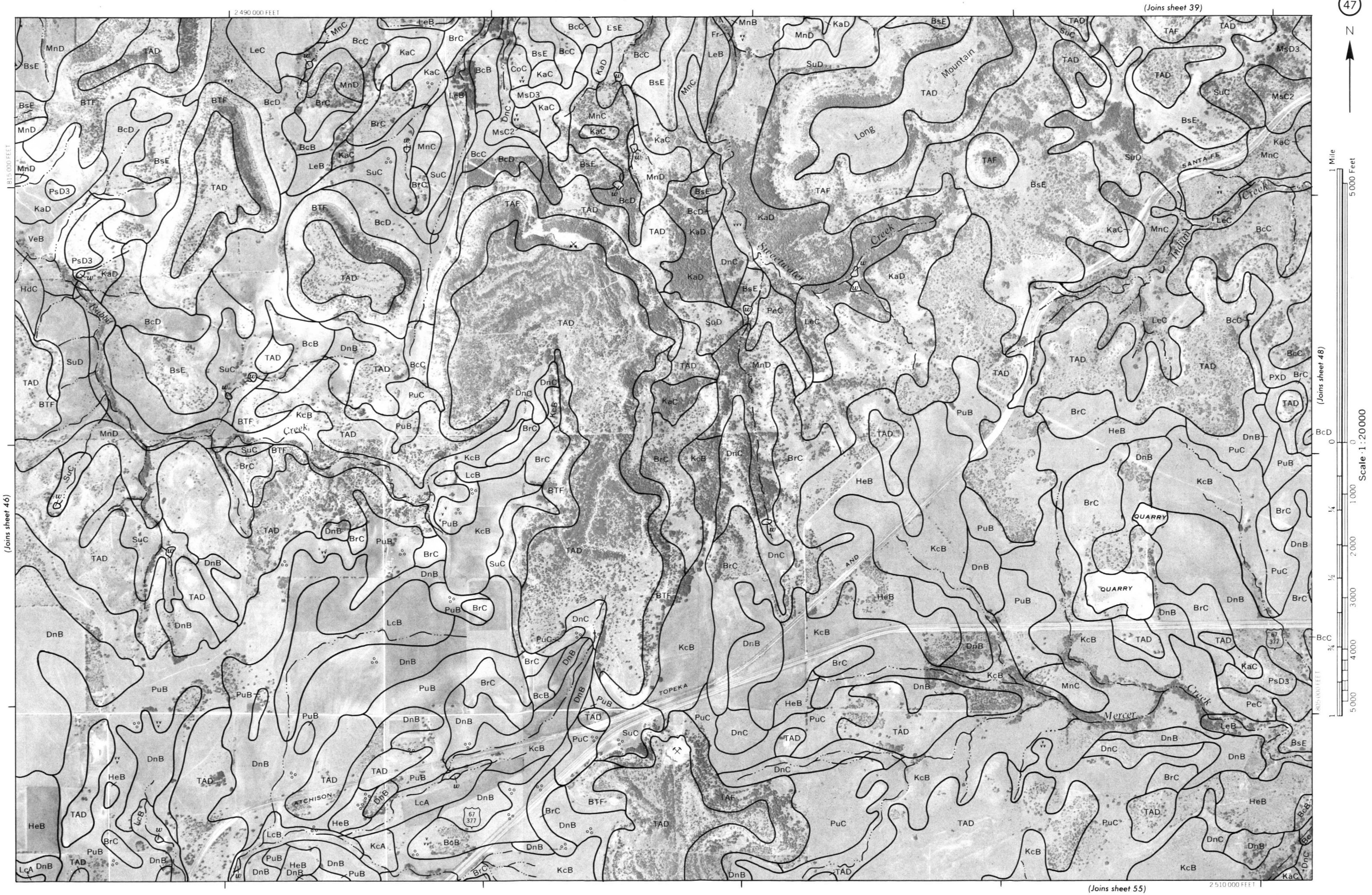


This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 46

COMANCHE COUNTY, TEXAS — SHEET NUMBER 47

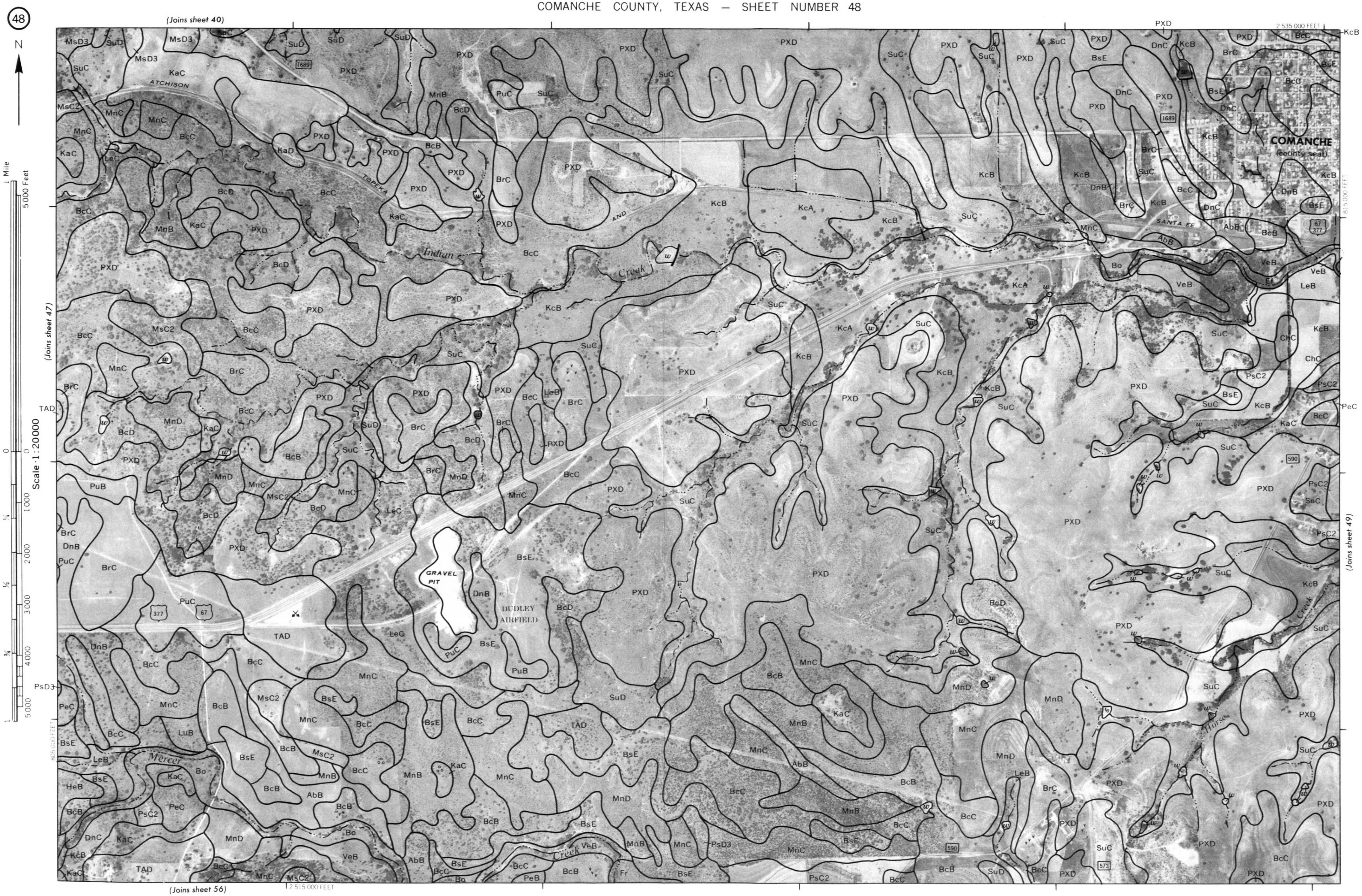
㊼



COMANCHE COUNTY, TEXAS NO. 47

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

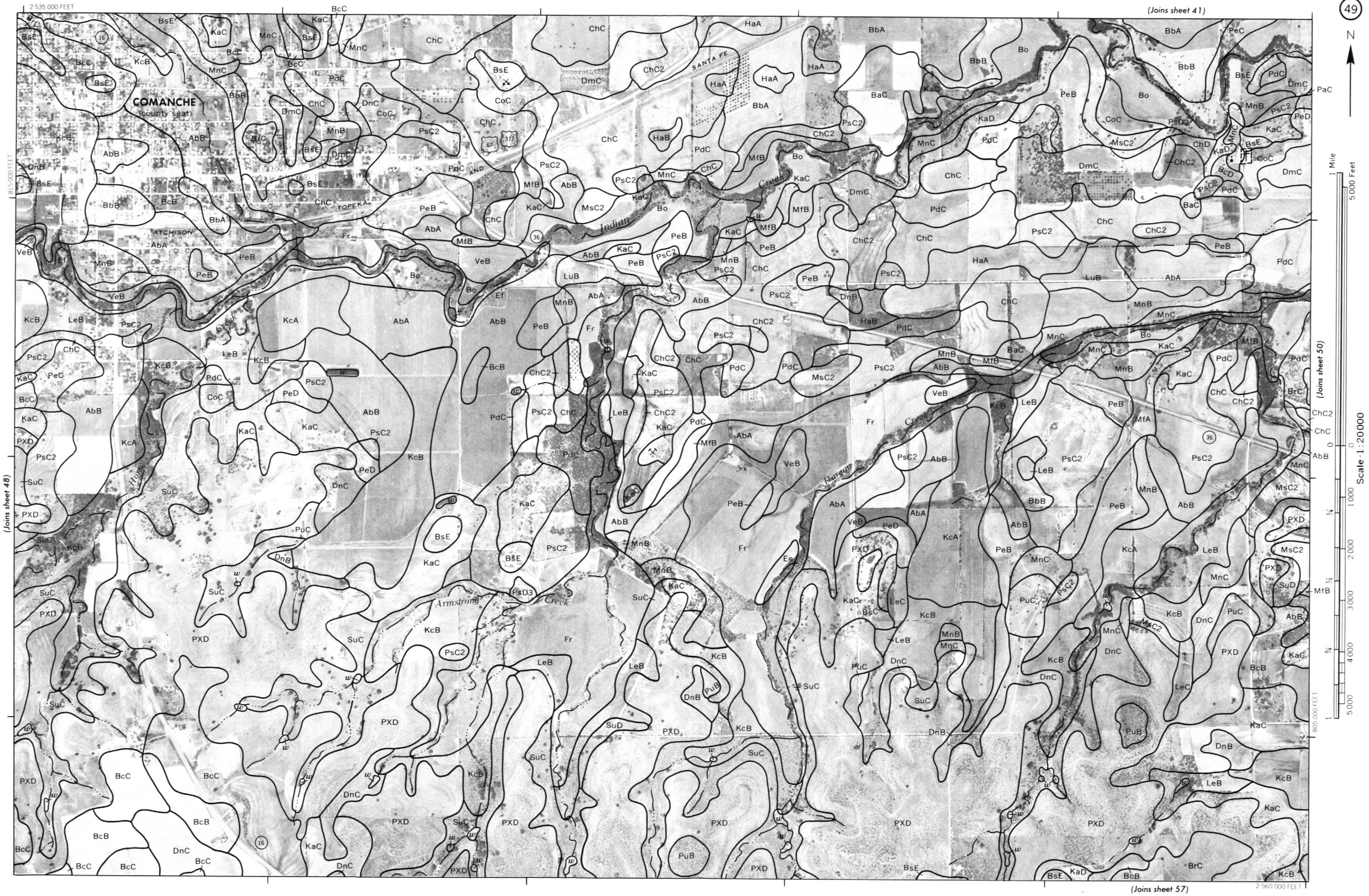
COMANCHE COUNTY, TEXAS — SHEET NUMBER 48



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 48

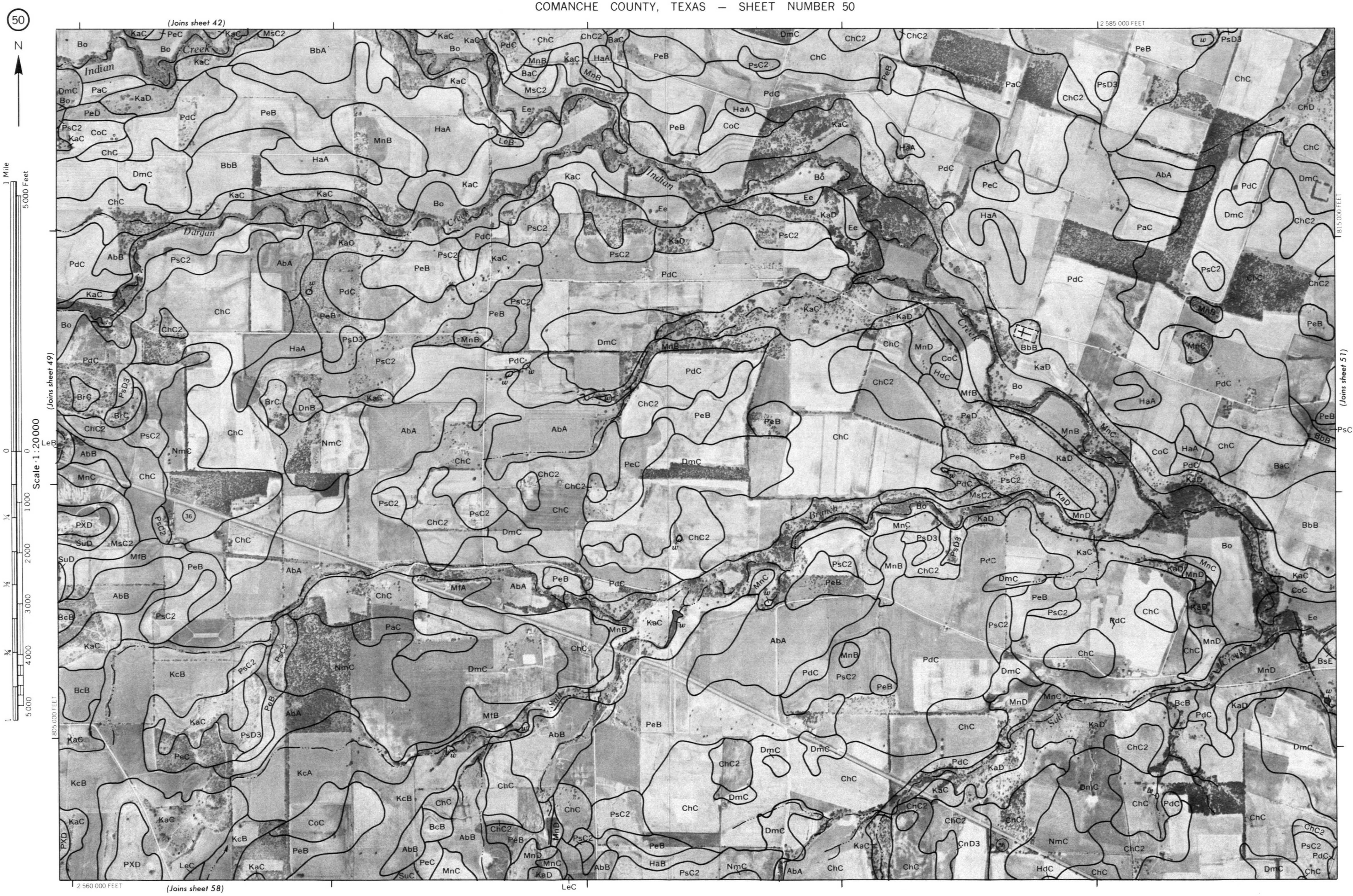
COMANCHE COUNTY, TEXAS — SHEET NUMBER 49



COMANCHE COUNTY, TEXAS NO. 49

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS — SHEET NUMBER 50



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

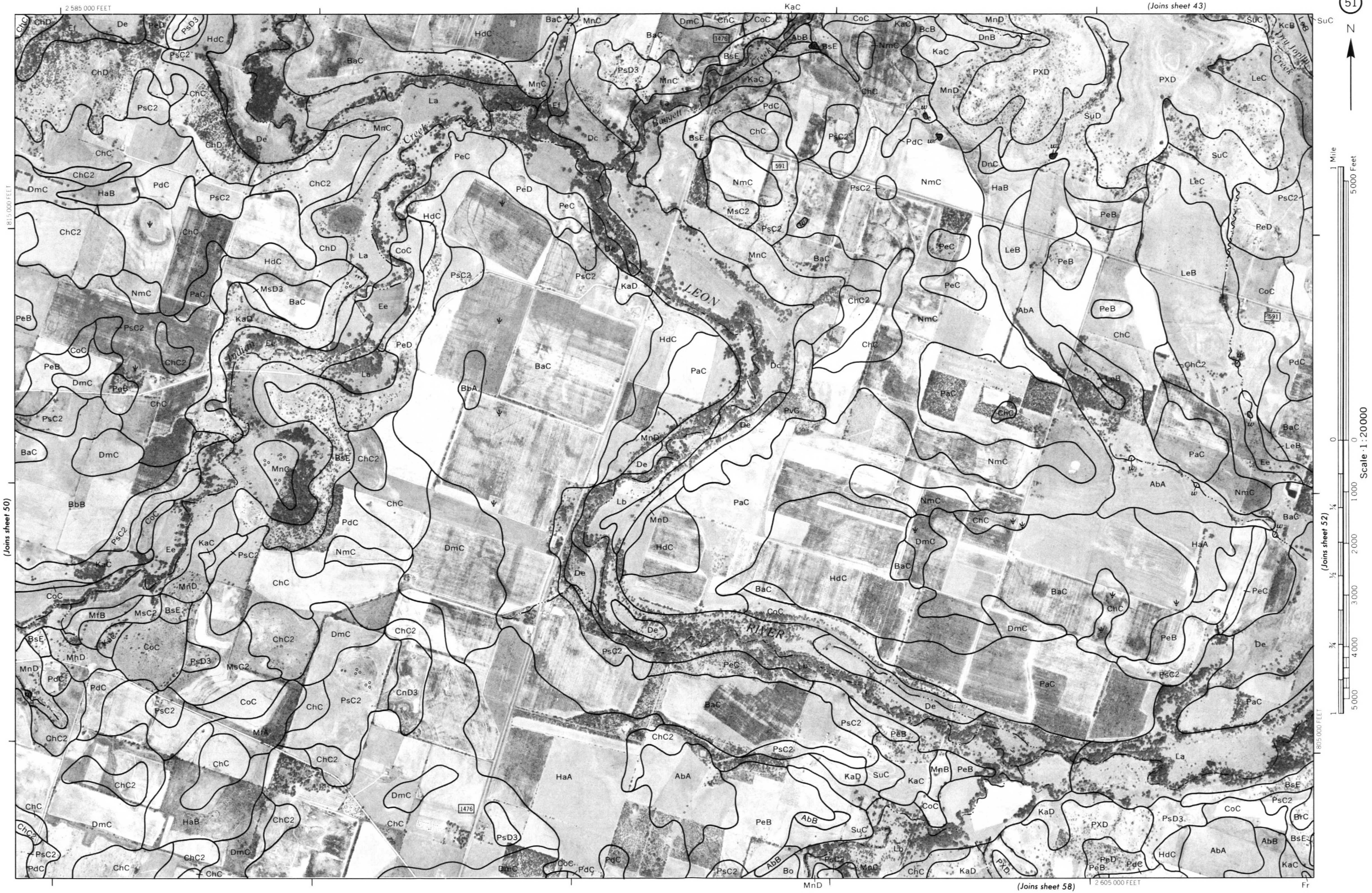
COMANCHE COUNTY, TEXAS NO. 50

COMANCHE COUNTY, TEXAS — SHEET NUMBER 51

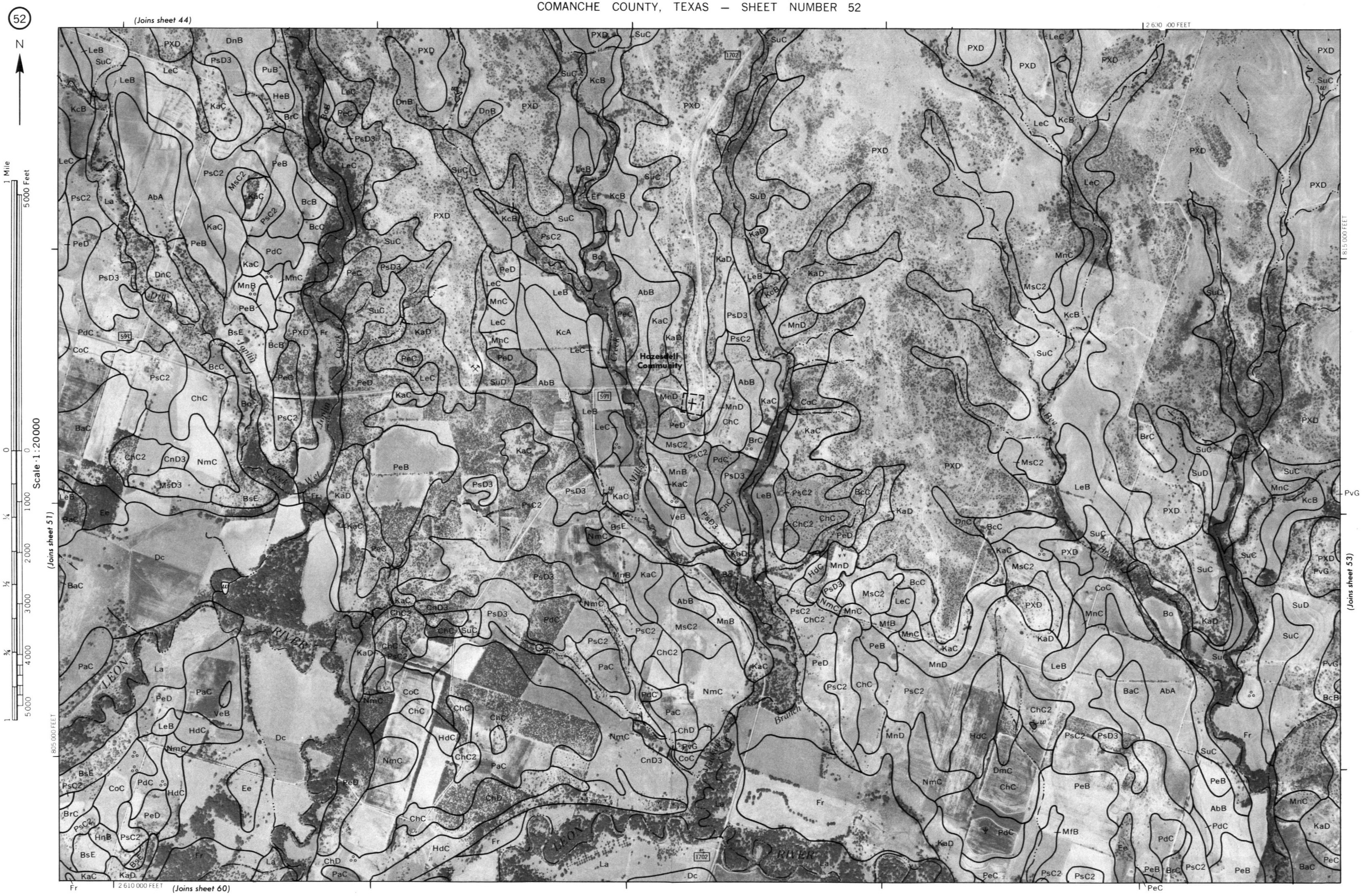
⑤①

COMANCHE COUNTY, TEXAS NO. 51

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



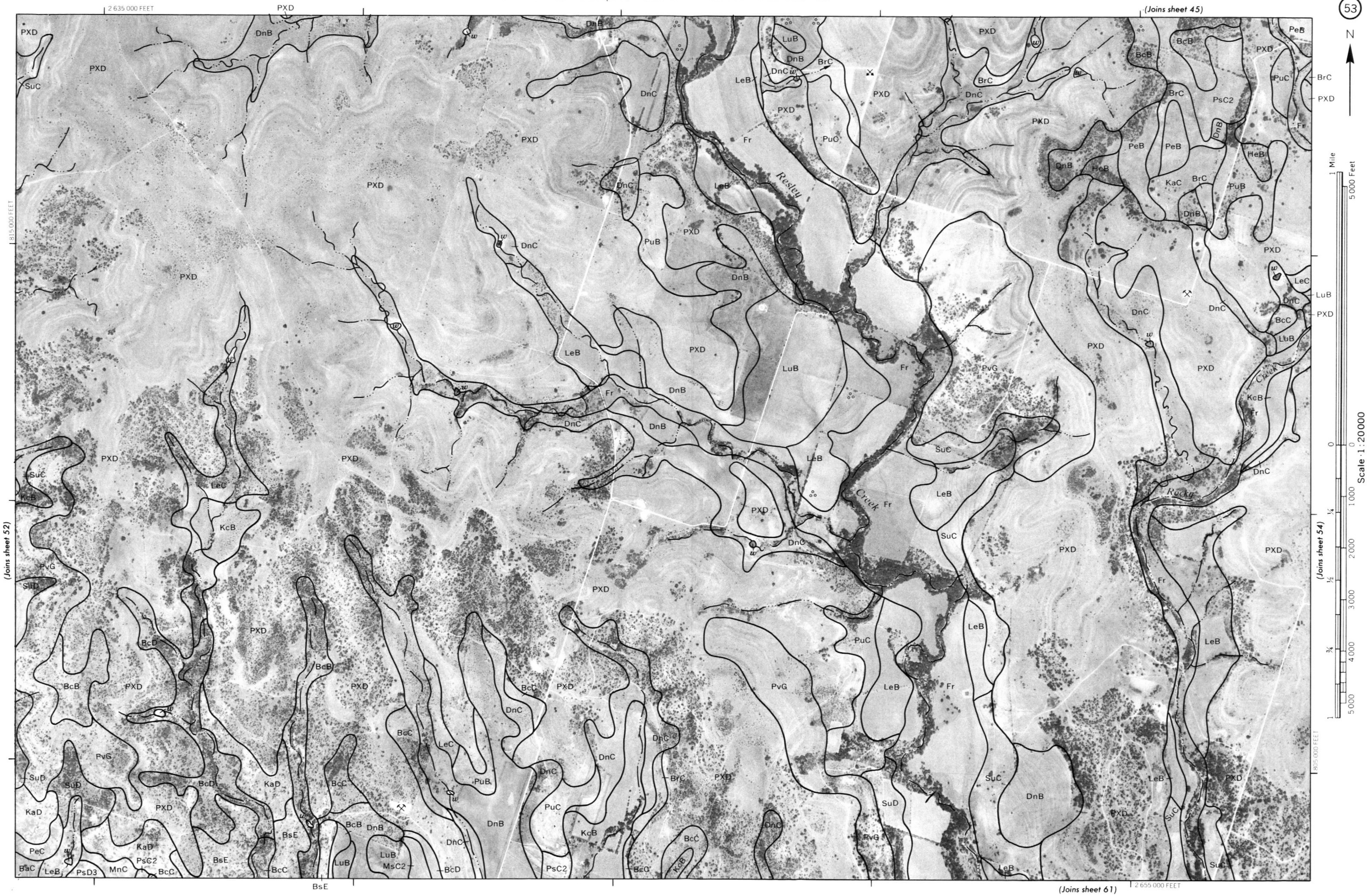
COMANCHE COUNTY, TEXAS — SHEET NUMBER 52



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 52

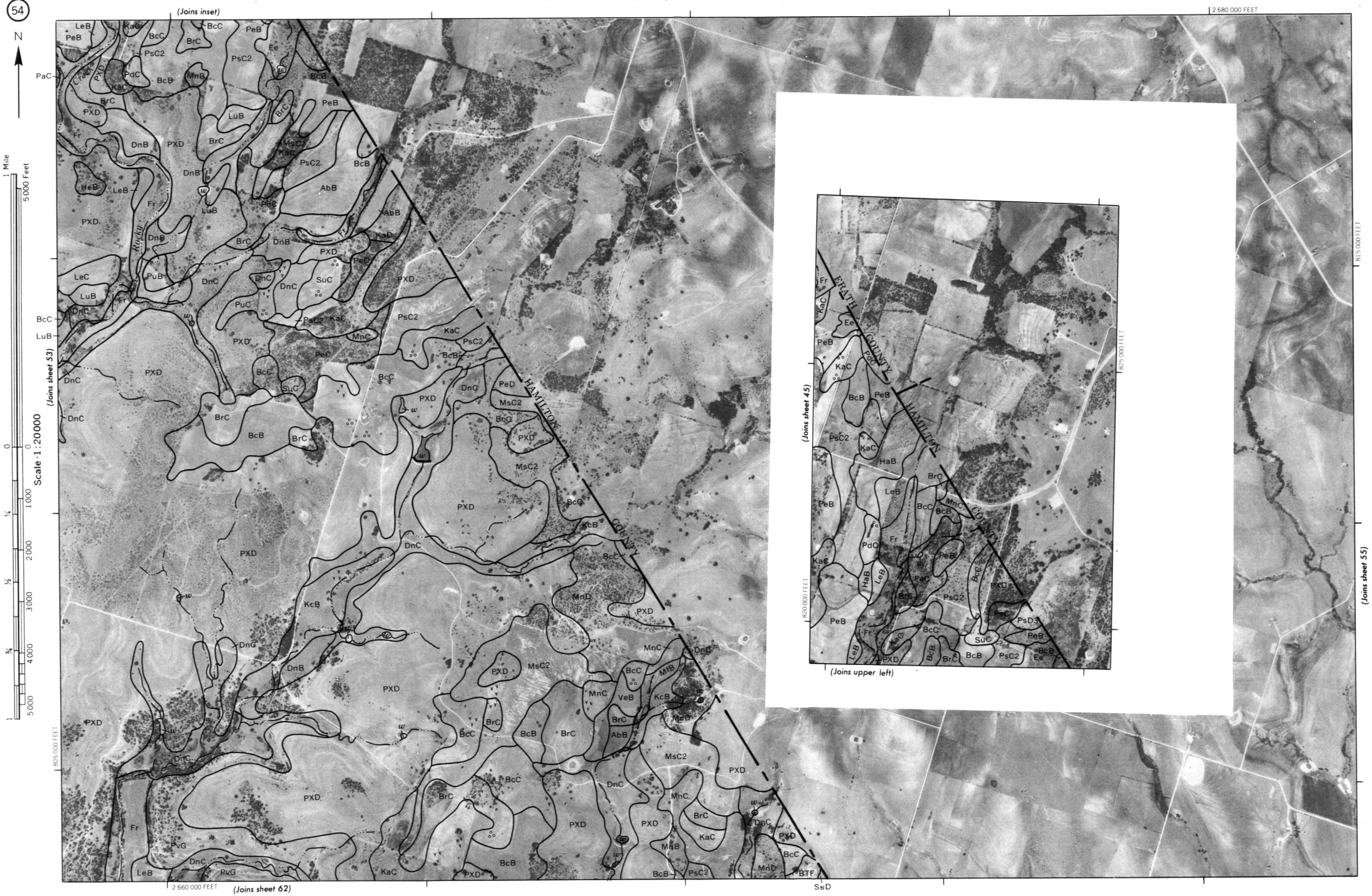
COMANCHE COUNTY, TEXAS — SHEET NUMBER 53



COMANCHE COUNTY, TEXAS NO. 53

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS — SHEET NUMBER 54



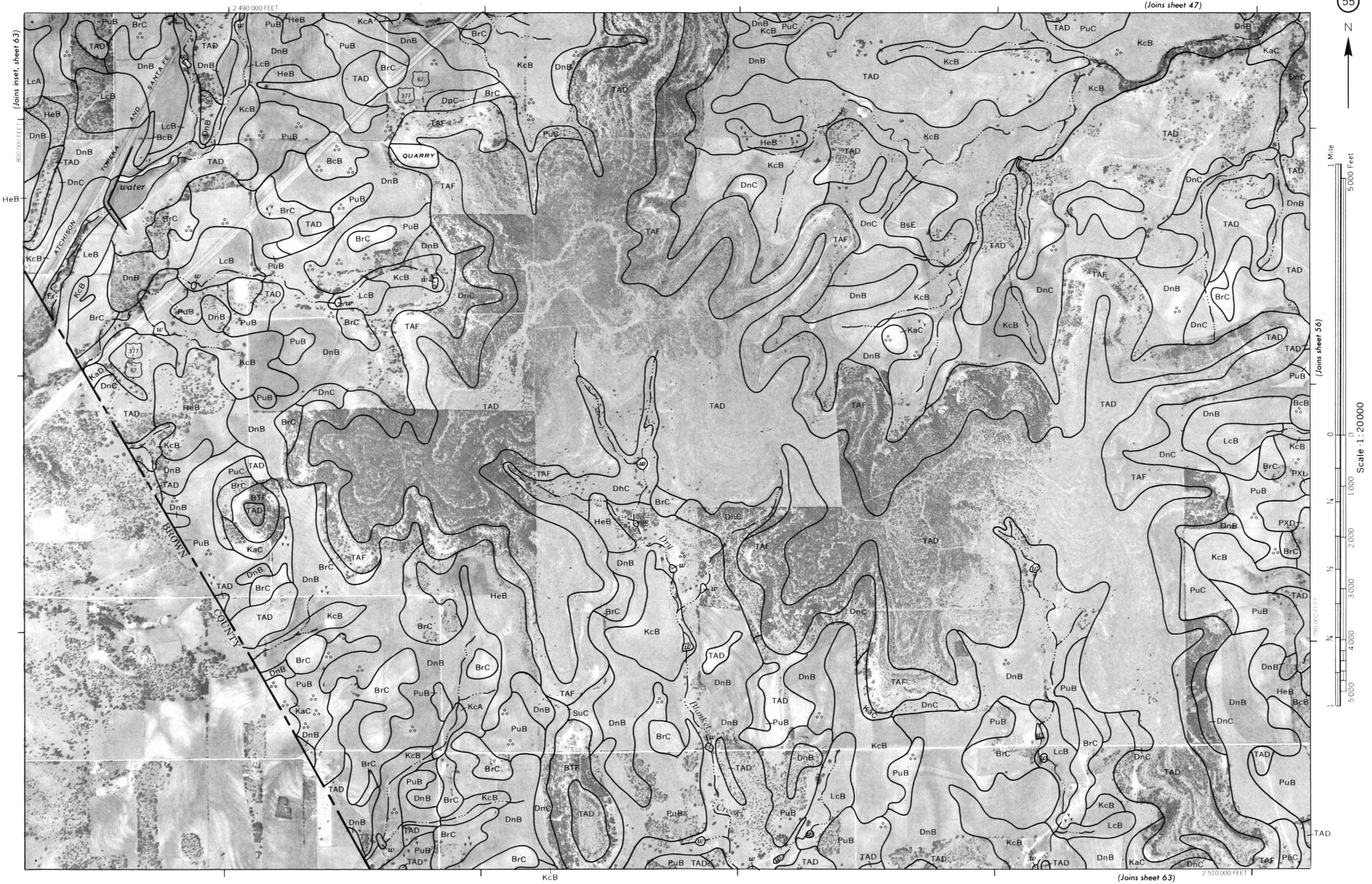
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 54

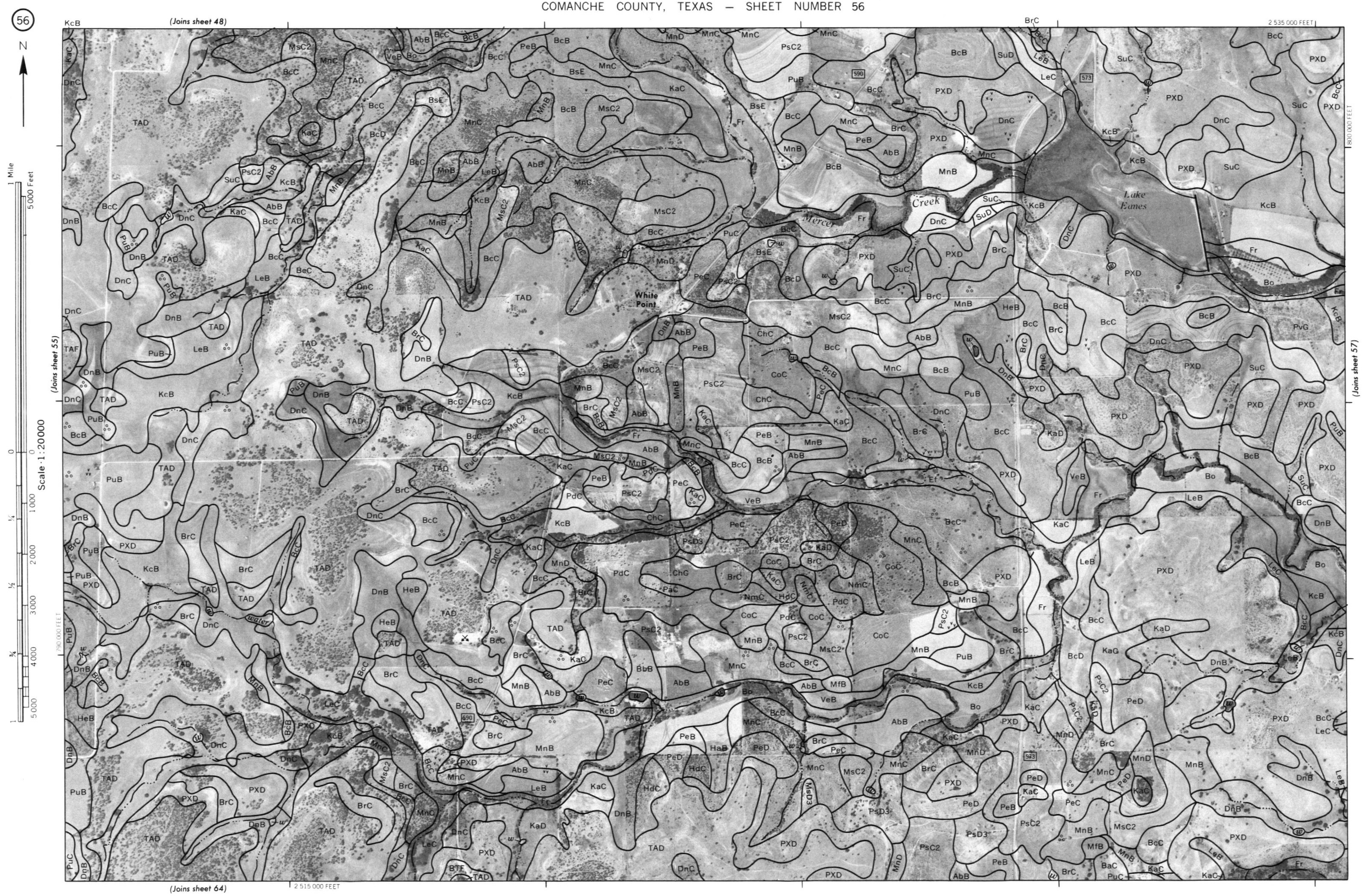
COMANCHE COUNTY, TEXAS — SHEET NUMBER 55

COMANCHE COUNTY, TEXAS NO. 55

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



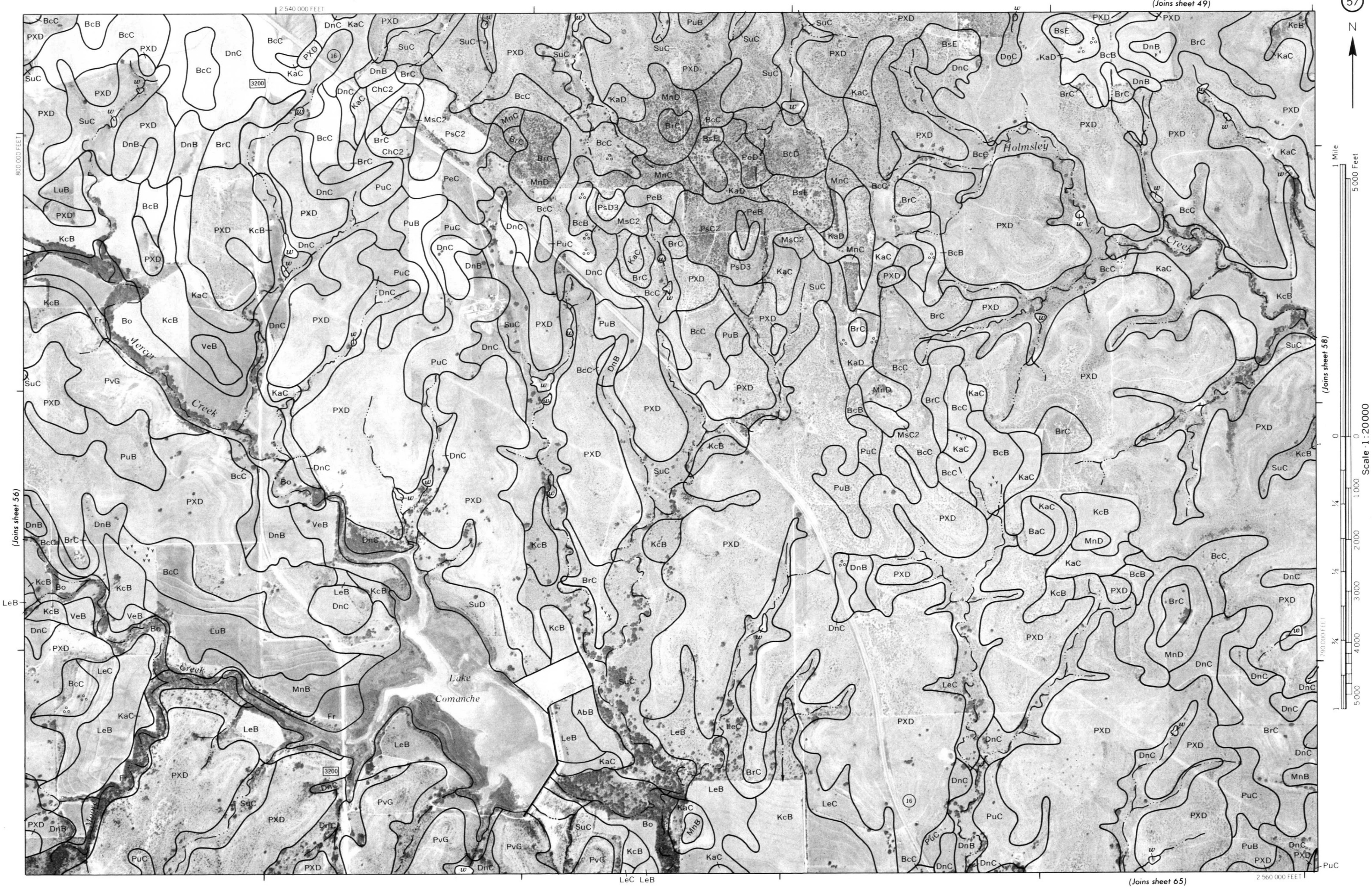
COMANCHE COUNTY, TEXAS — SHEET NUMBER 56



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 56

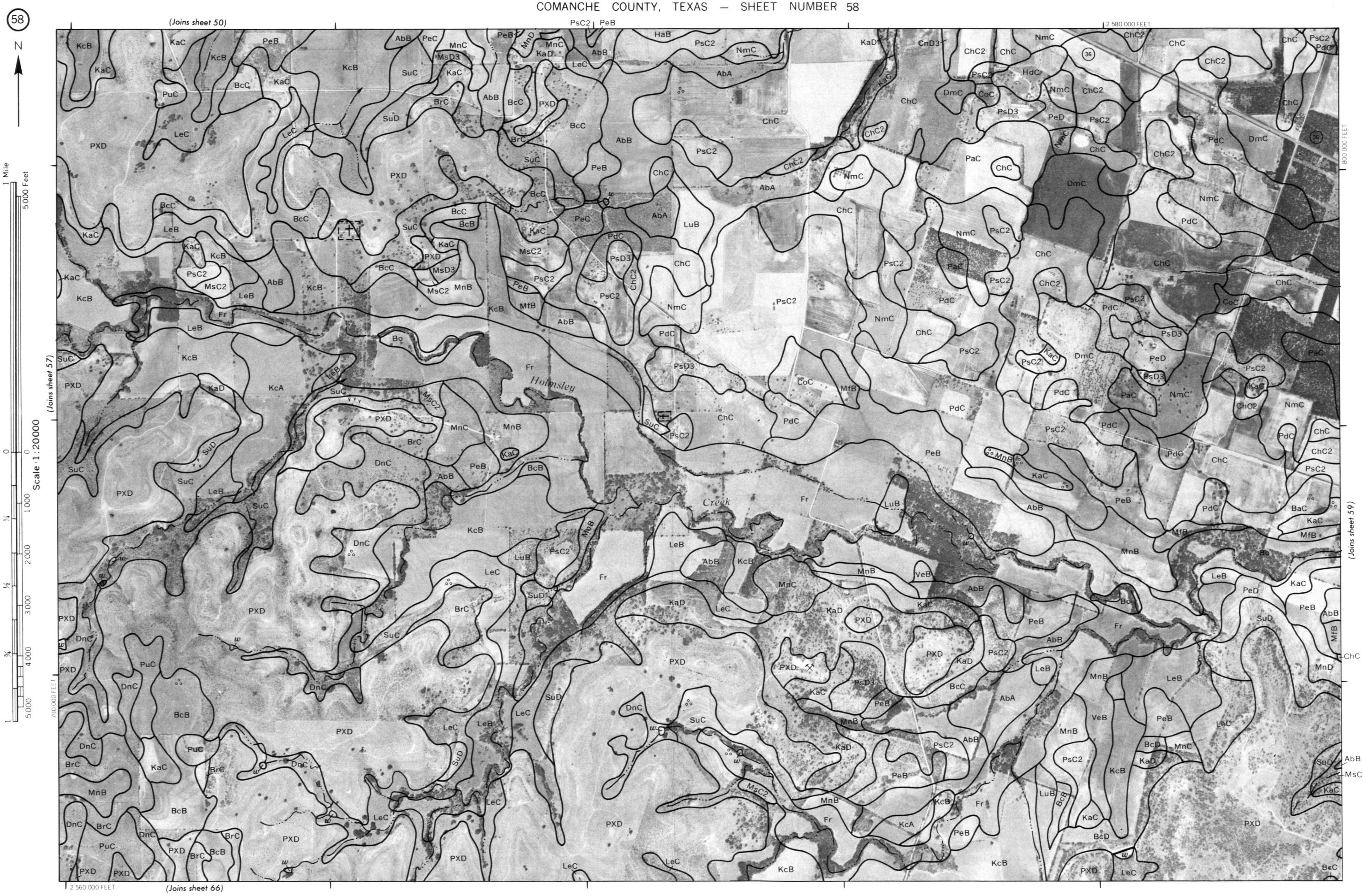
COMANCHE COUNTY, TEXAS — SHEET NUMBER 57



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 57

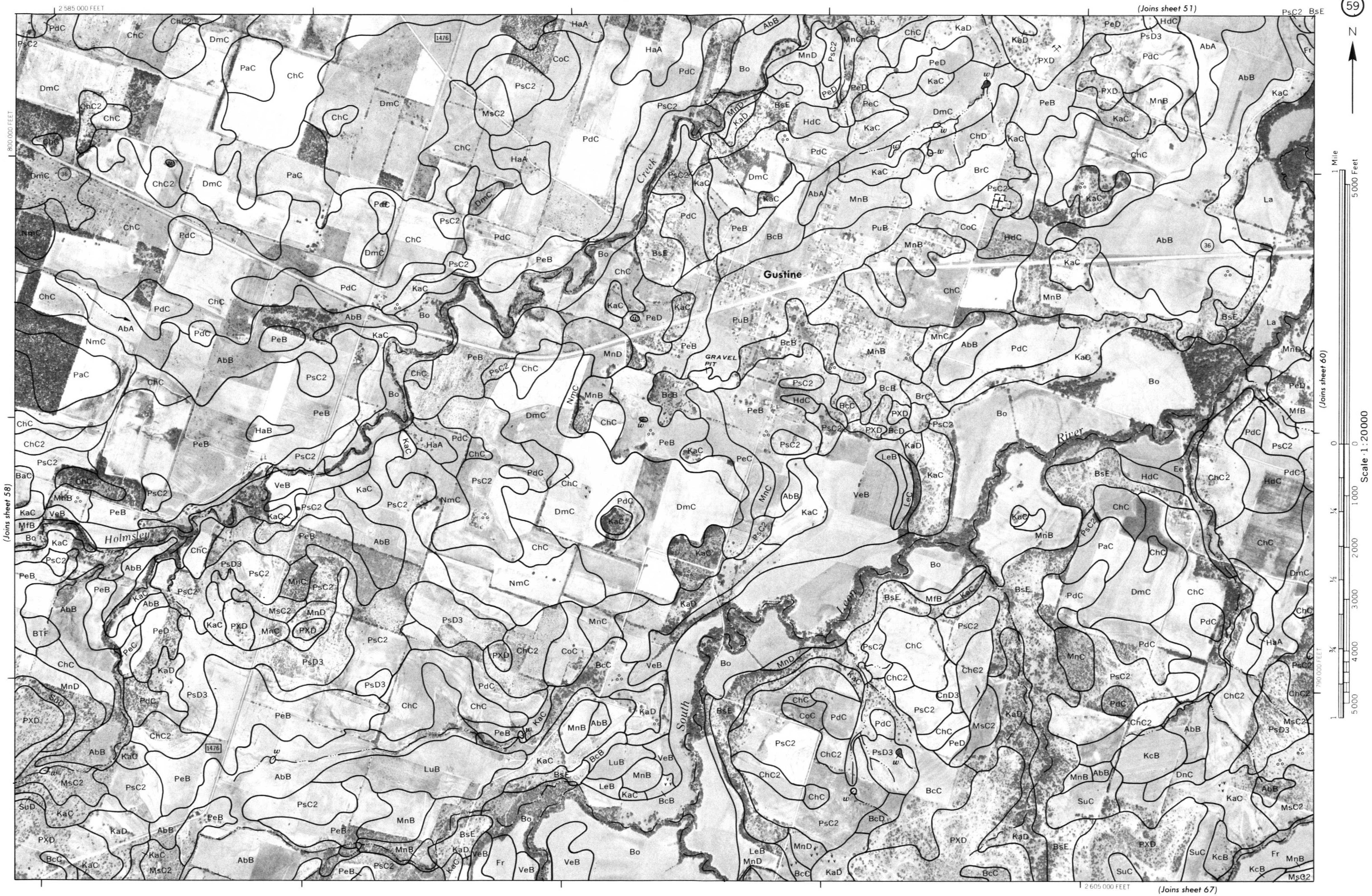
COMANCHE COUNTY, TEXAS — SHEET NUMBER 58



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 58

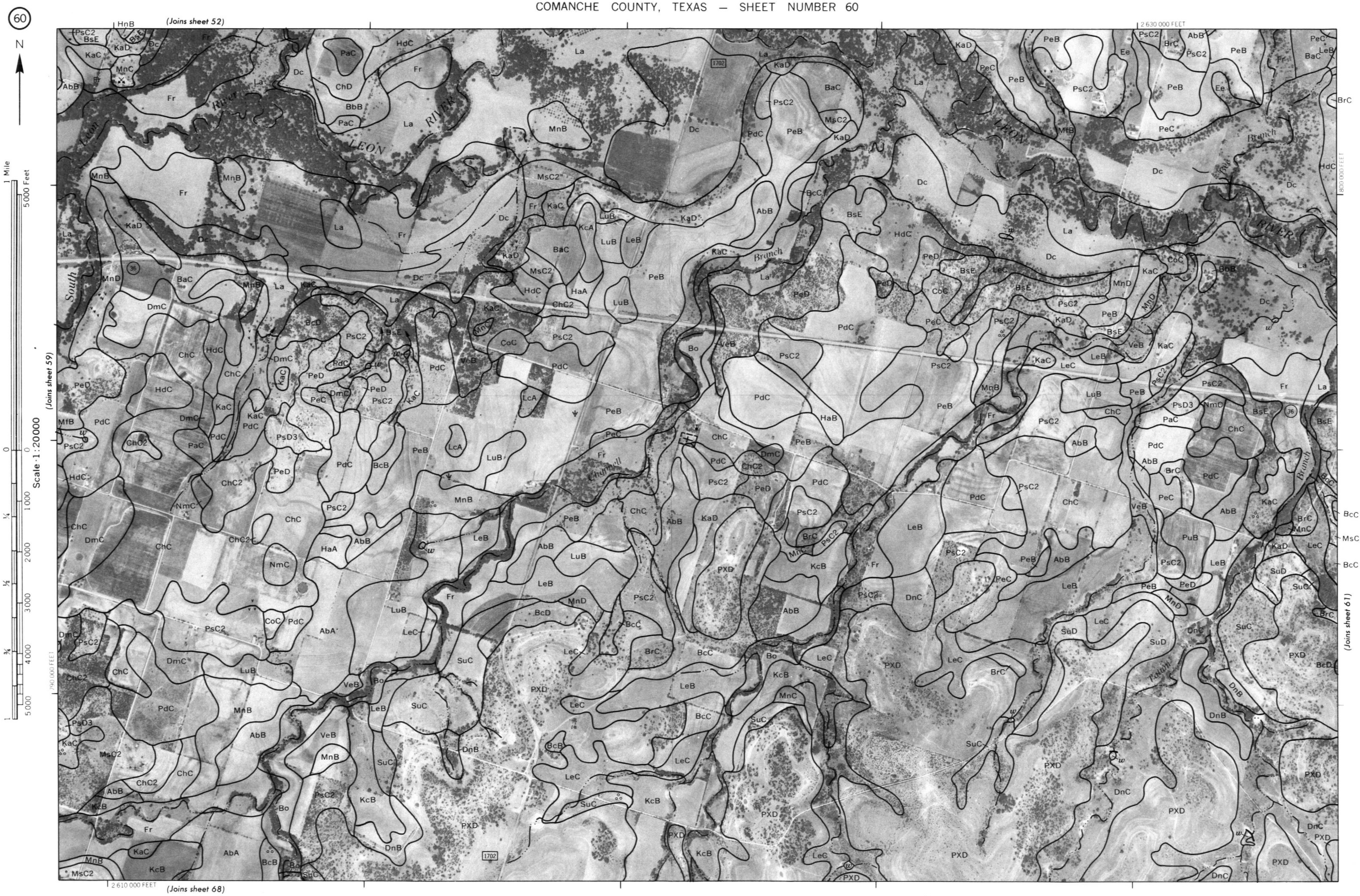
COMANCHE COUNTY, TEXAS — SHEET NUMBER 59



COMANCHE COUNTY, TEXAS NO. 59

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS — SHEET NUMBER 60



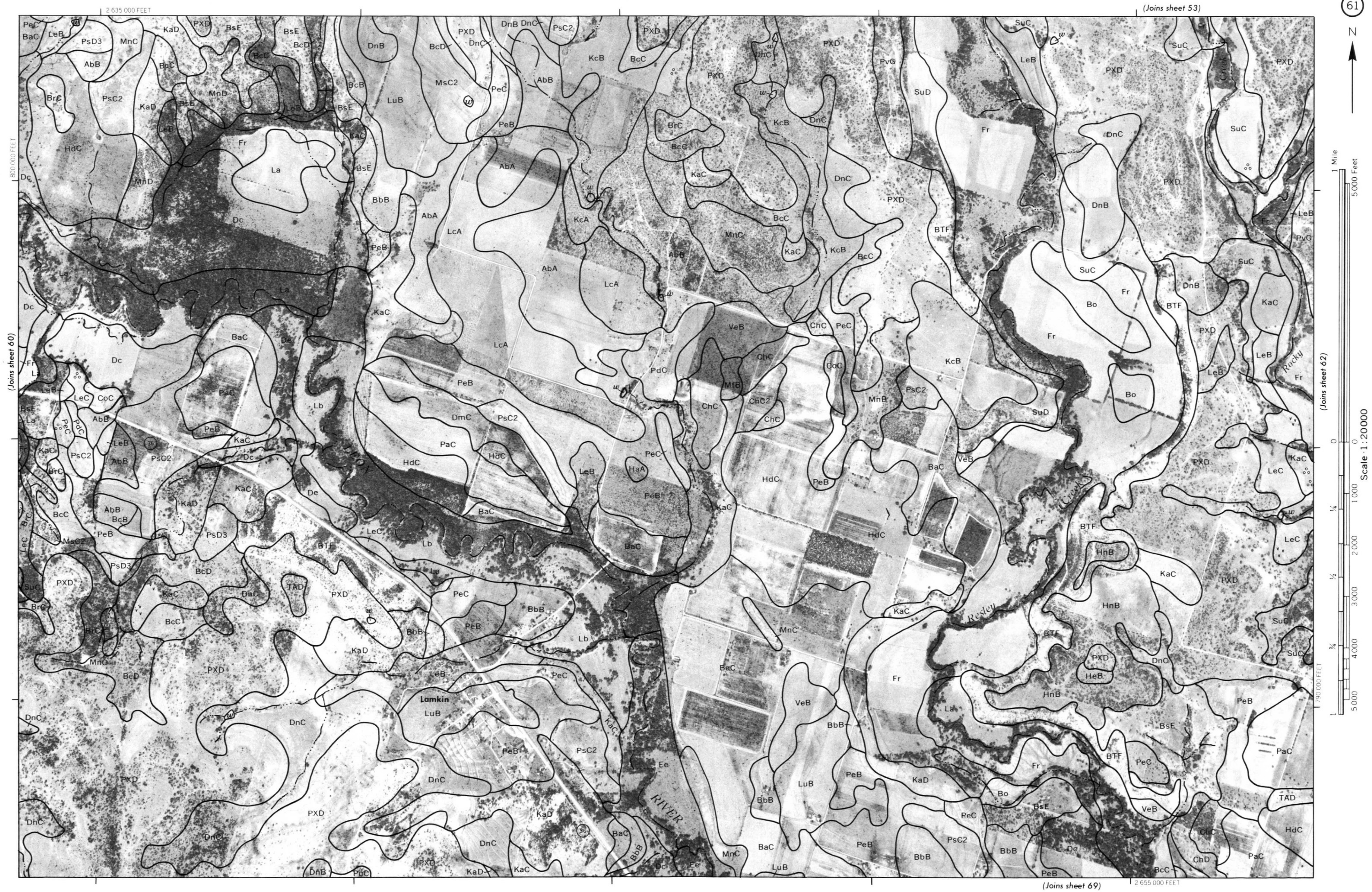
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 60

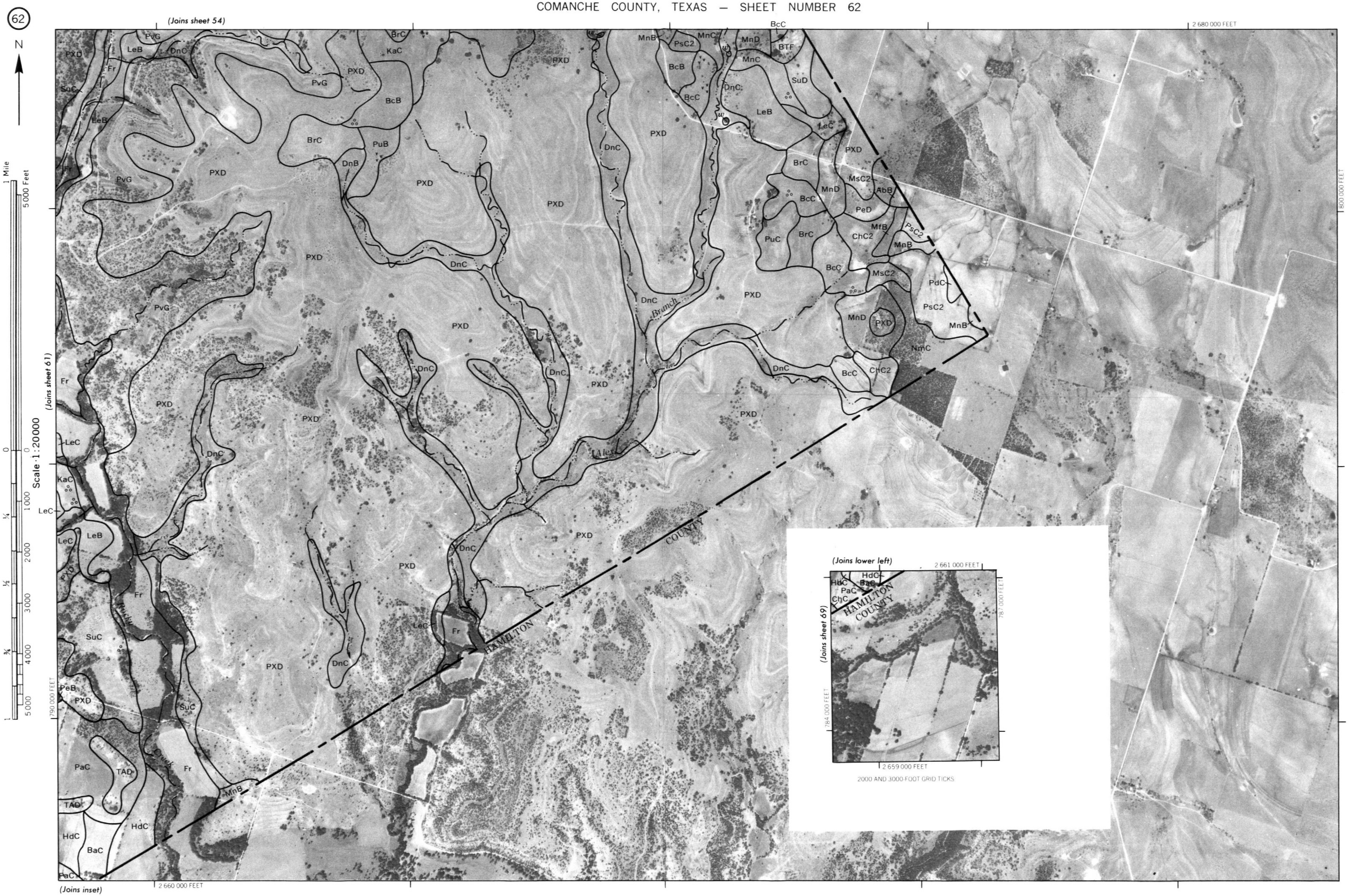
COMANCHE COUNTY, TEXAS — SHEET NUMBER 61

COMANCHE COUNTY, TEXAS NO. 61

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



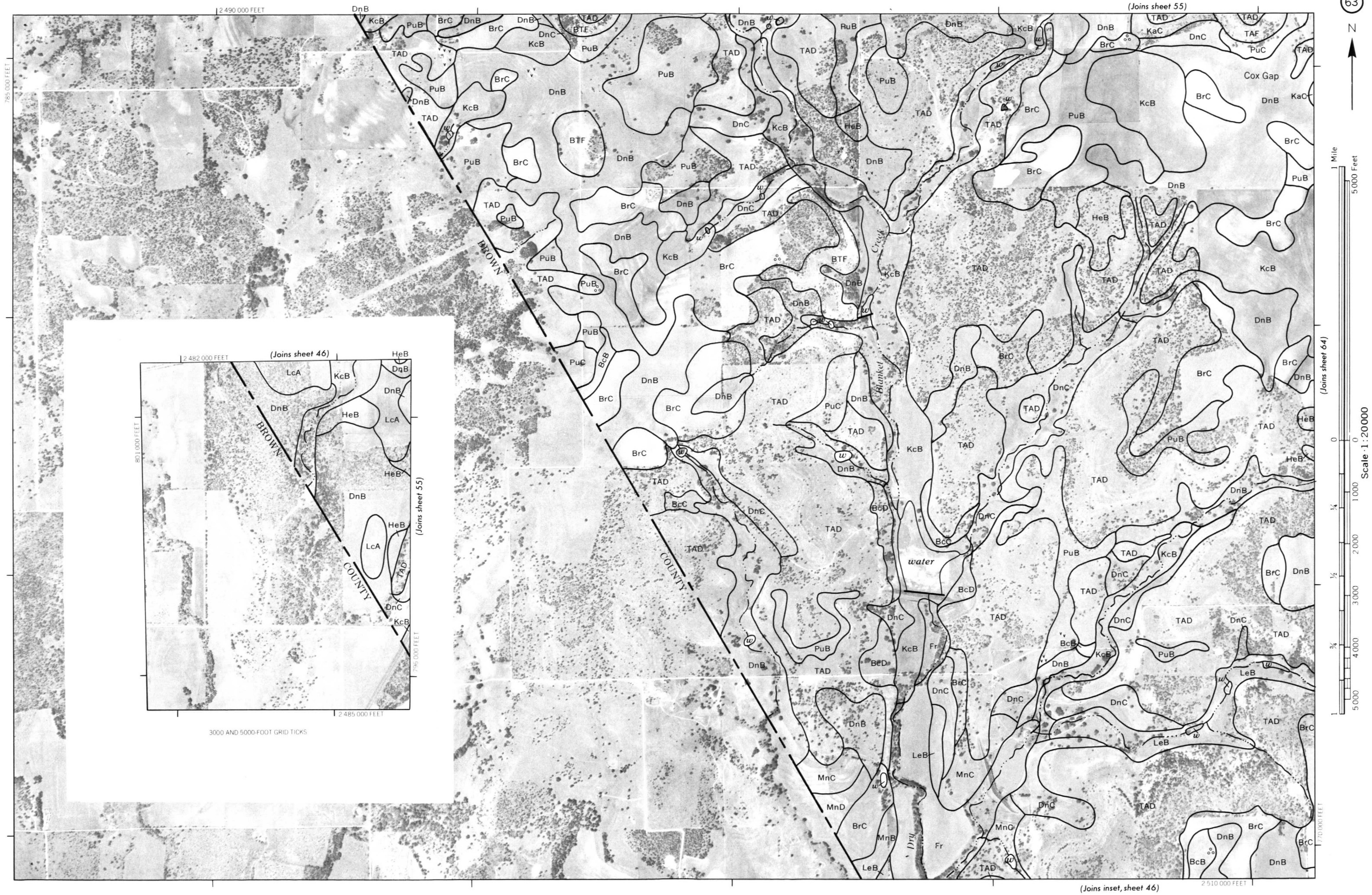
COMANCHE COUNTY, TEXAS — SHEET NUMBER 62



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 62

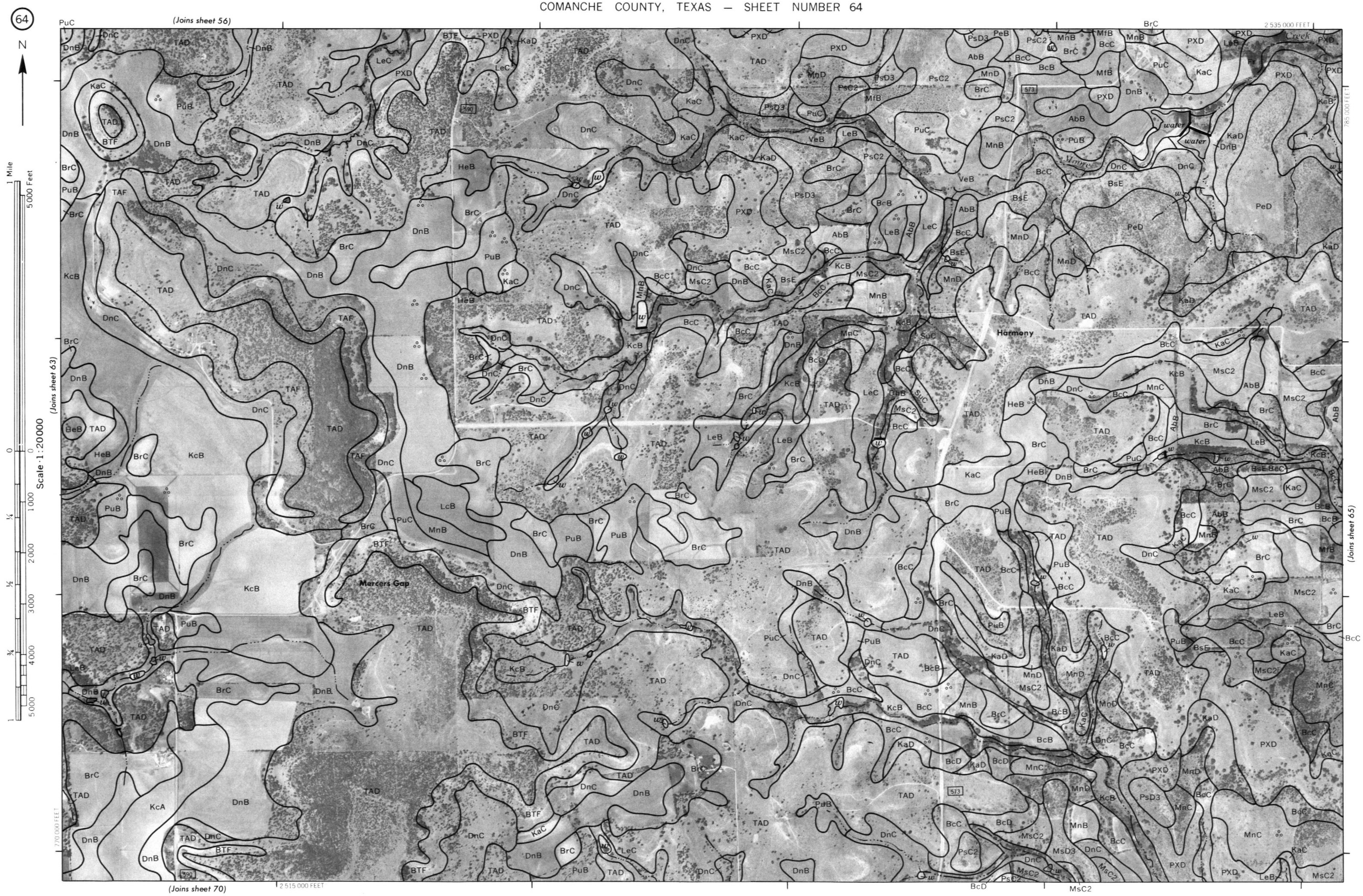
COMANCHE COUNTY, TEXAS — SHEET NUMBER 63



COMANCHE COUNTY, TEXAS NO. 63

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS — SHEET NUMBER 64



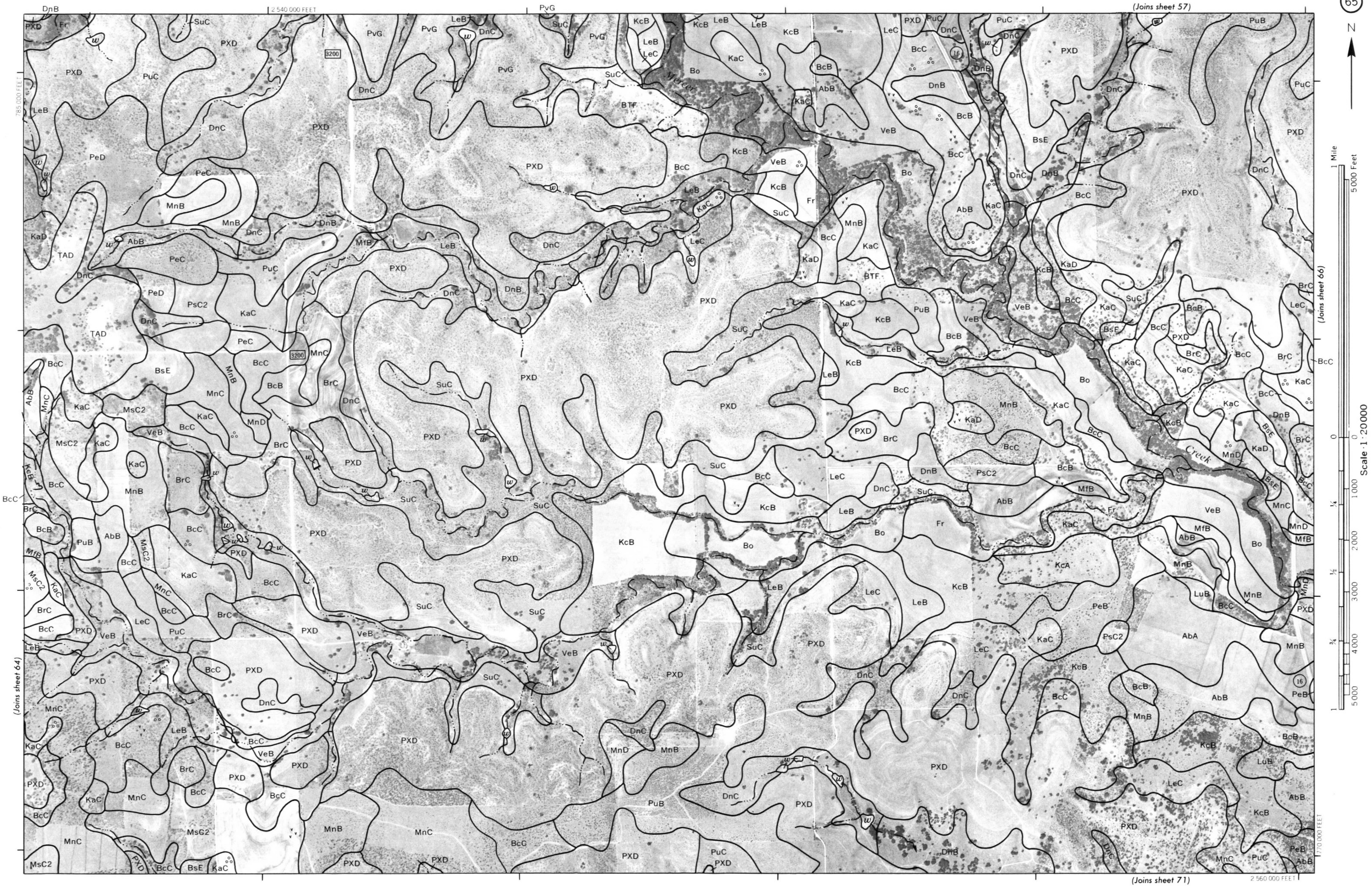
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 64

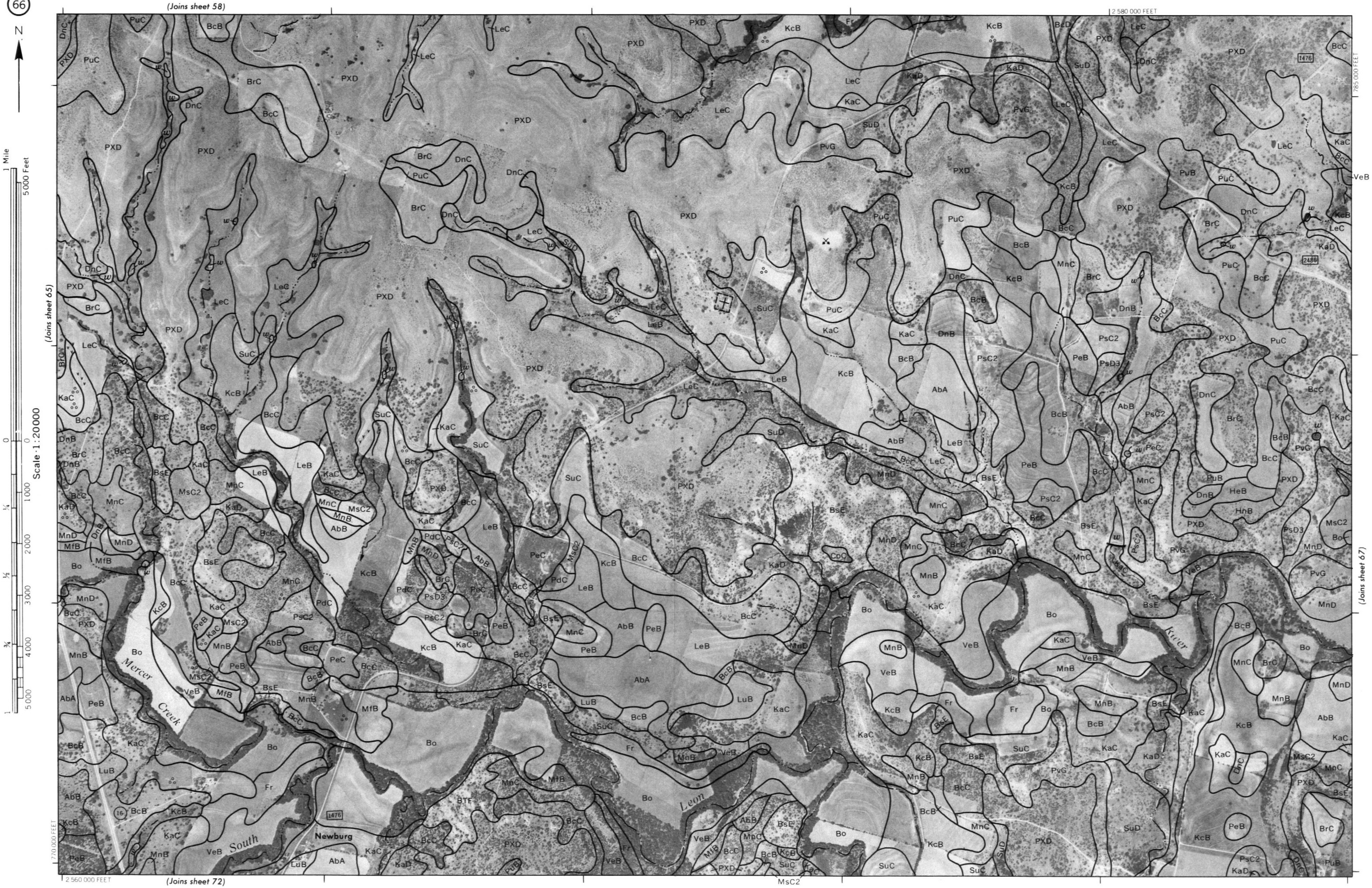
COMANCHE COUNTY, TEXAS — SHEET NUMBER 65

COMANCHE COUNTY, TEXAS NO. 65

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



COMANCHE COUNTY, TEXAS — SHEET NUMBER 66



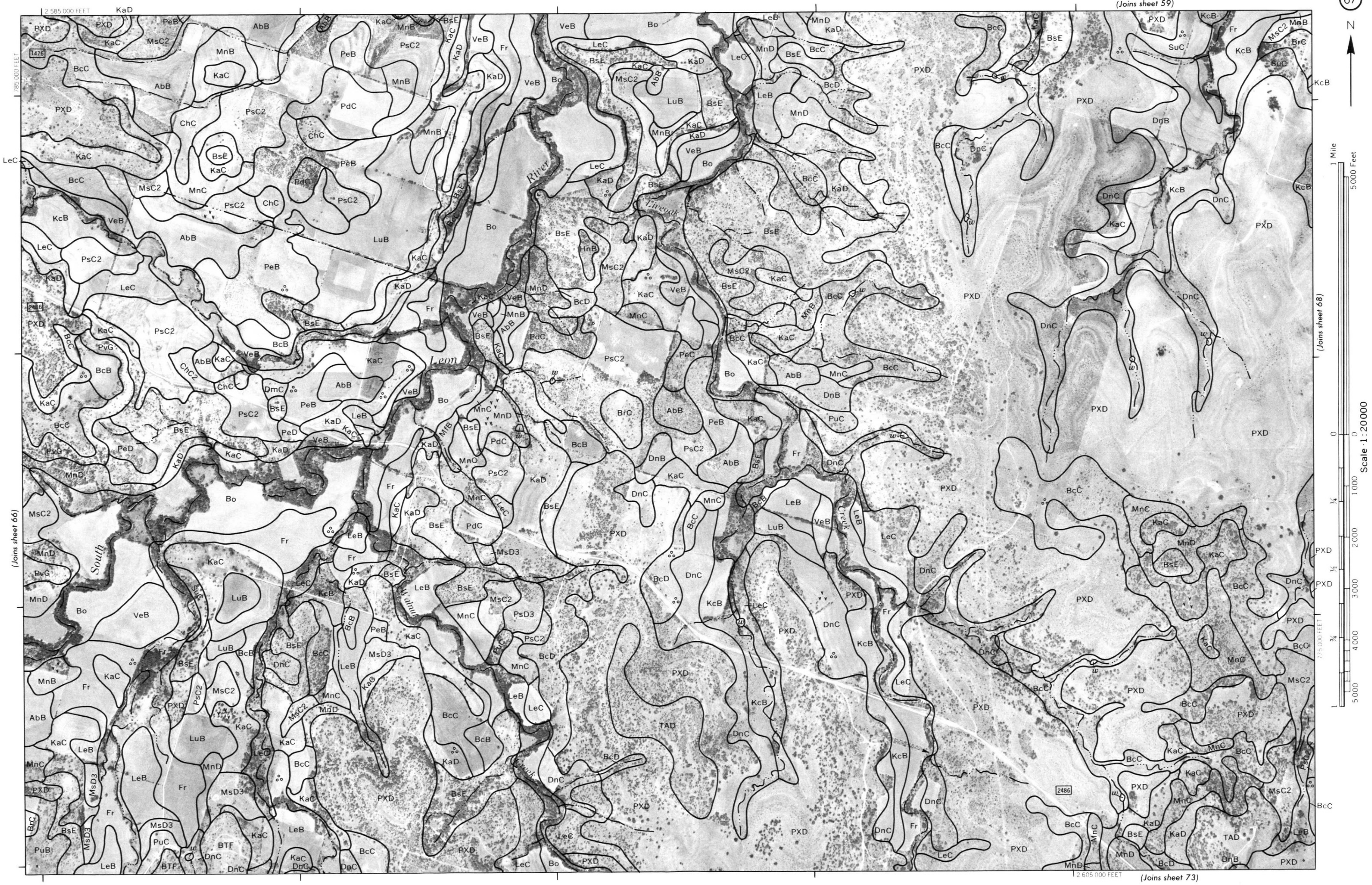
COMANCHE COUNTY, TEXAS NO. 66

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

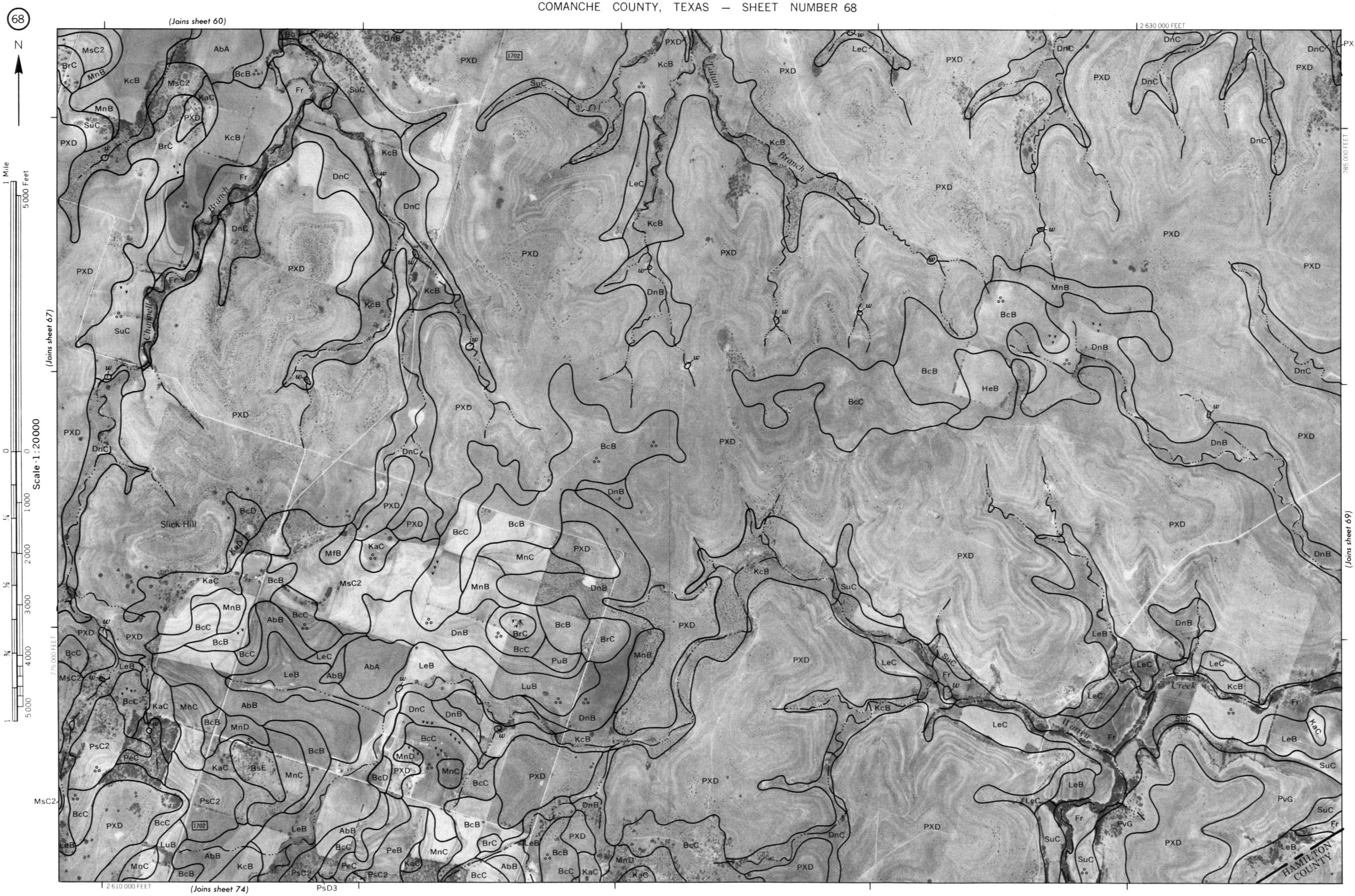
COMANCHE COUNTY, TEXAS — SHEET NUMBER 67

COMANCHE COUNTY, TEXAS NO. 67

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



COMANCHE COUNTY, TEXAS — SHEET NUMBER 68



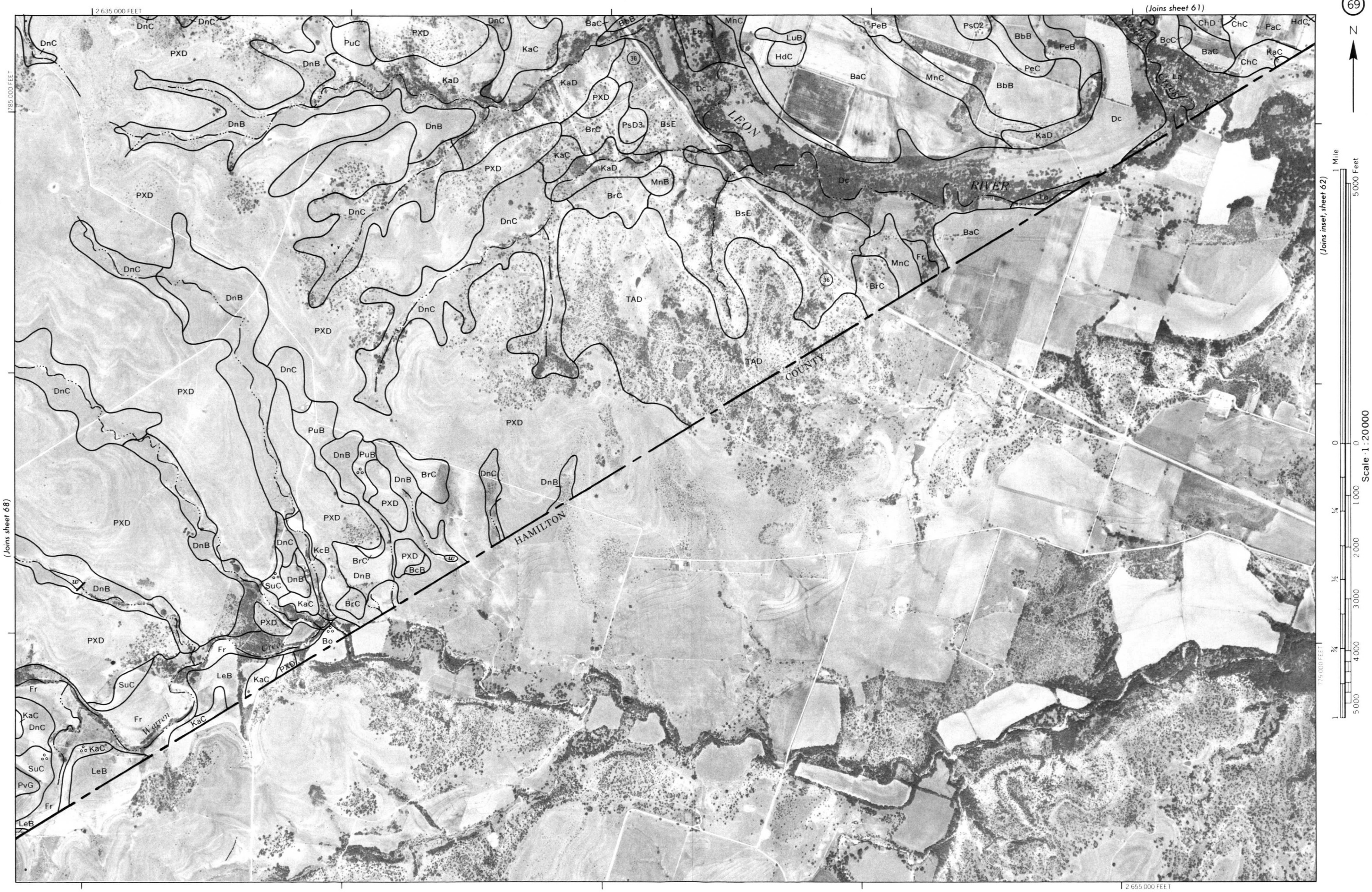
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 68

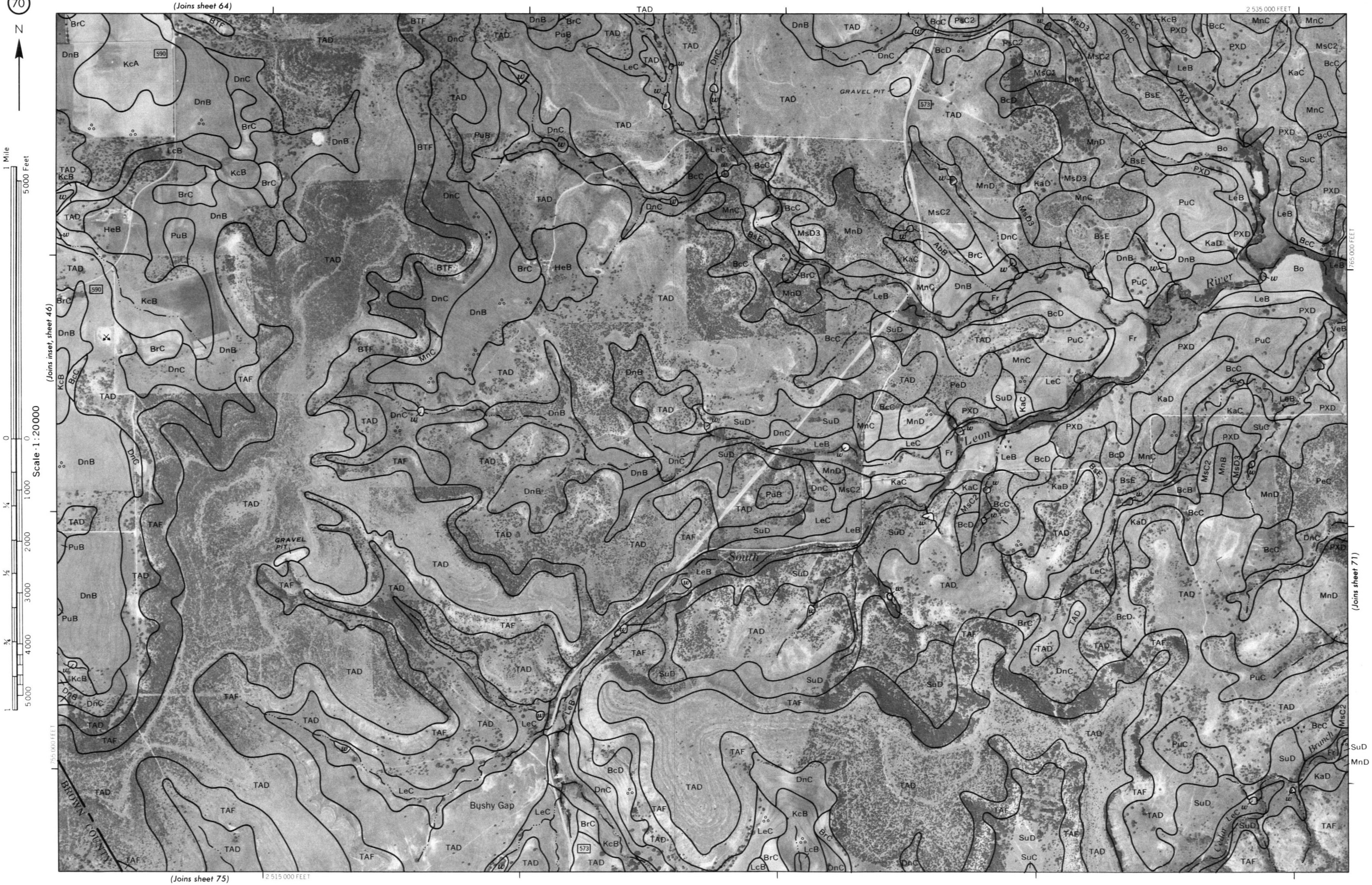
COMANCHE COUNTY, TEXAS — SHEET NUMBER 69

COMANCHE COUNTY, TEXAS NO. 69

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



COMANCHE COUNTY, TEXAS — SHEET NUMBER 70



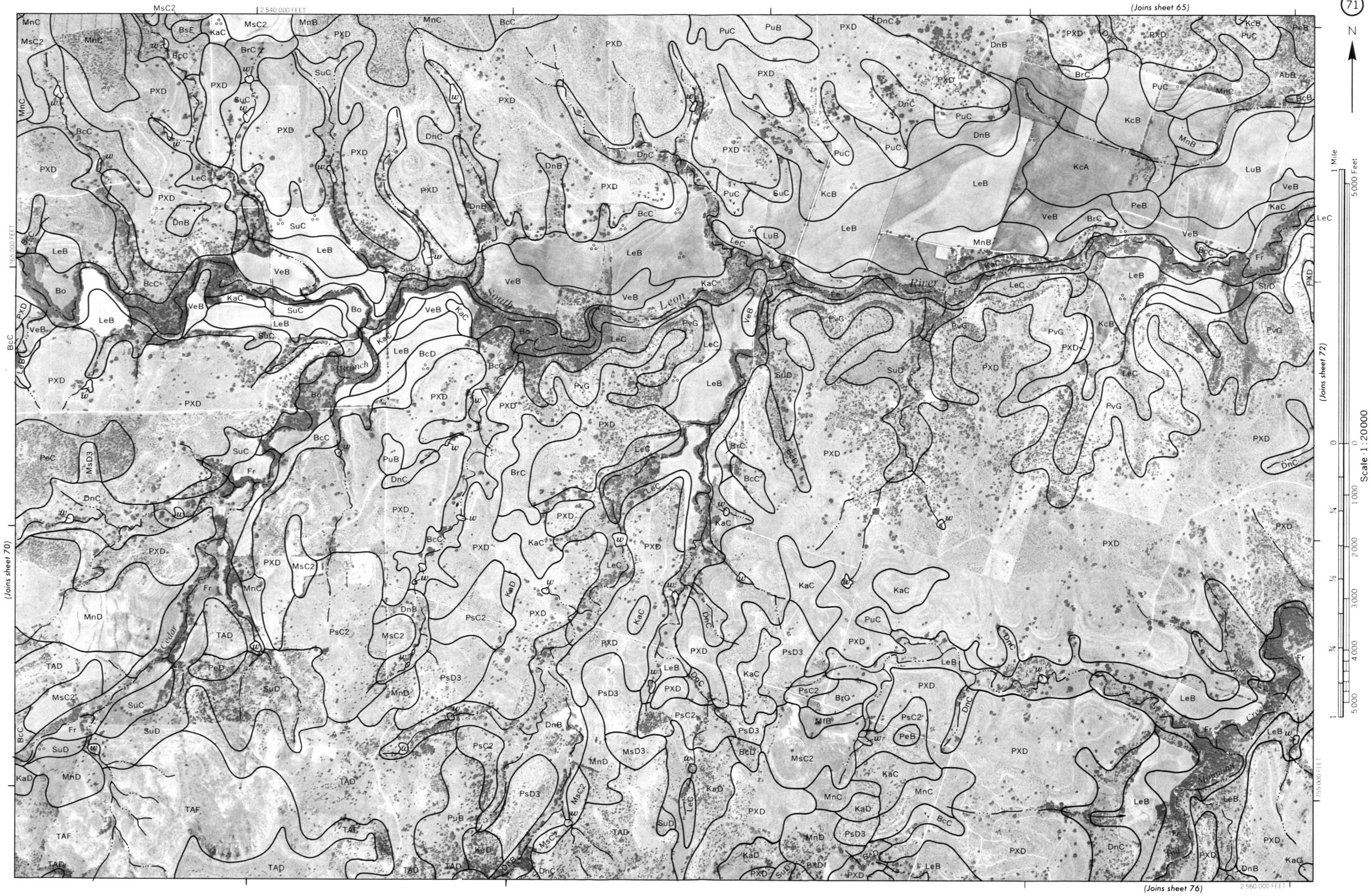
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 70

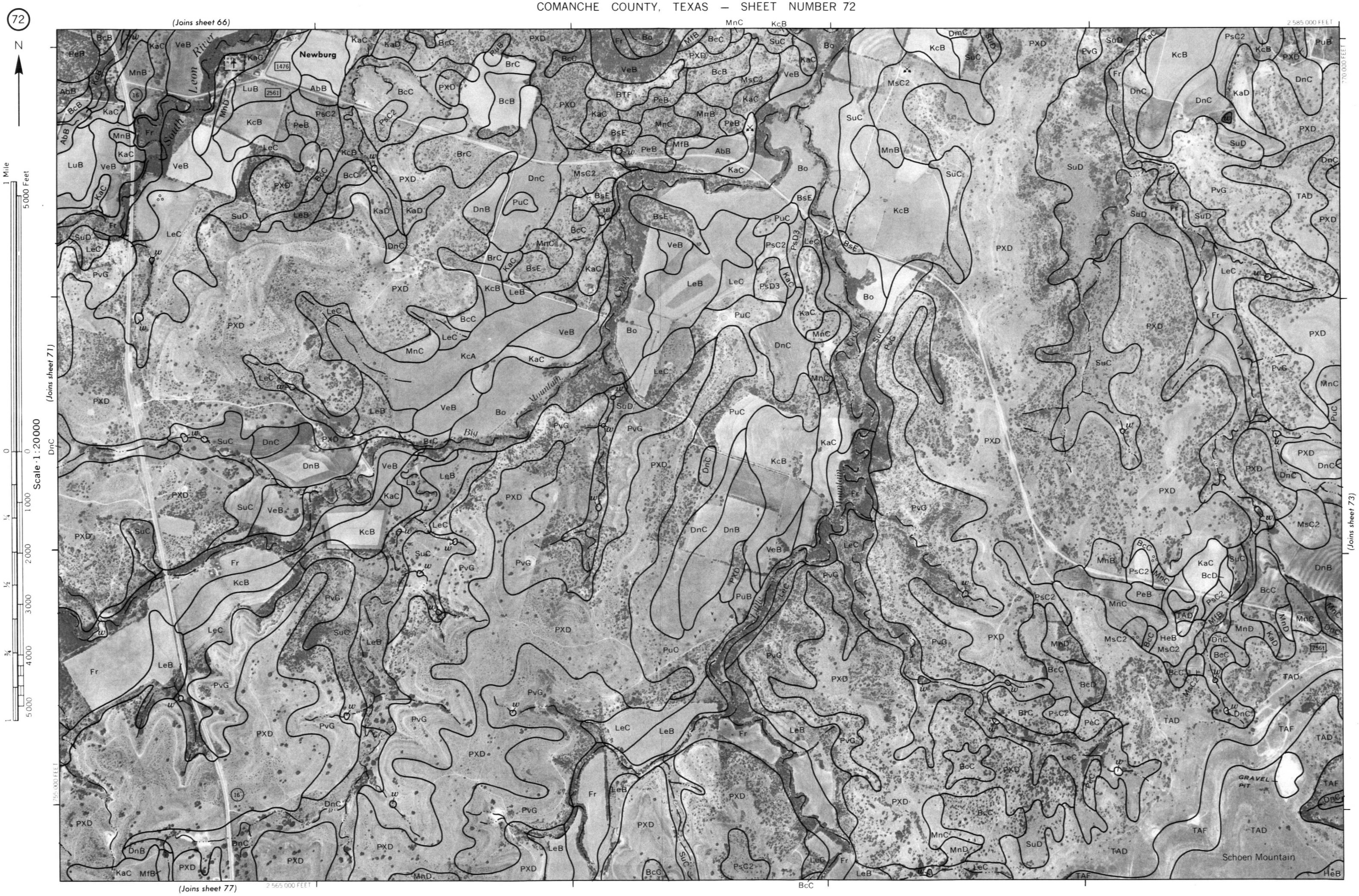
COMANCHE COUNTY, TEXAS — SHEET NUMBER 71

COMANCHE COUNTY, TEXAS NO. 71

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



COMANCHE COUNTY, TEXAS — SHEET NUMBER 72



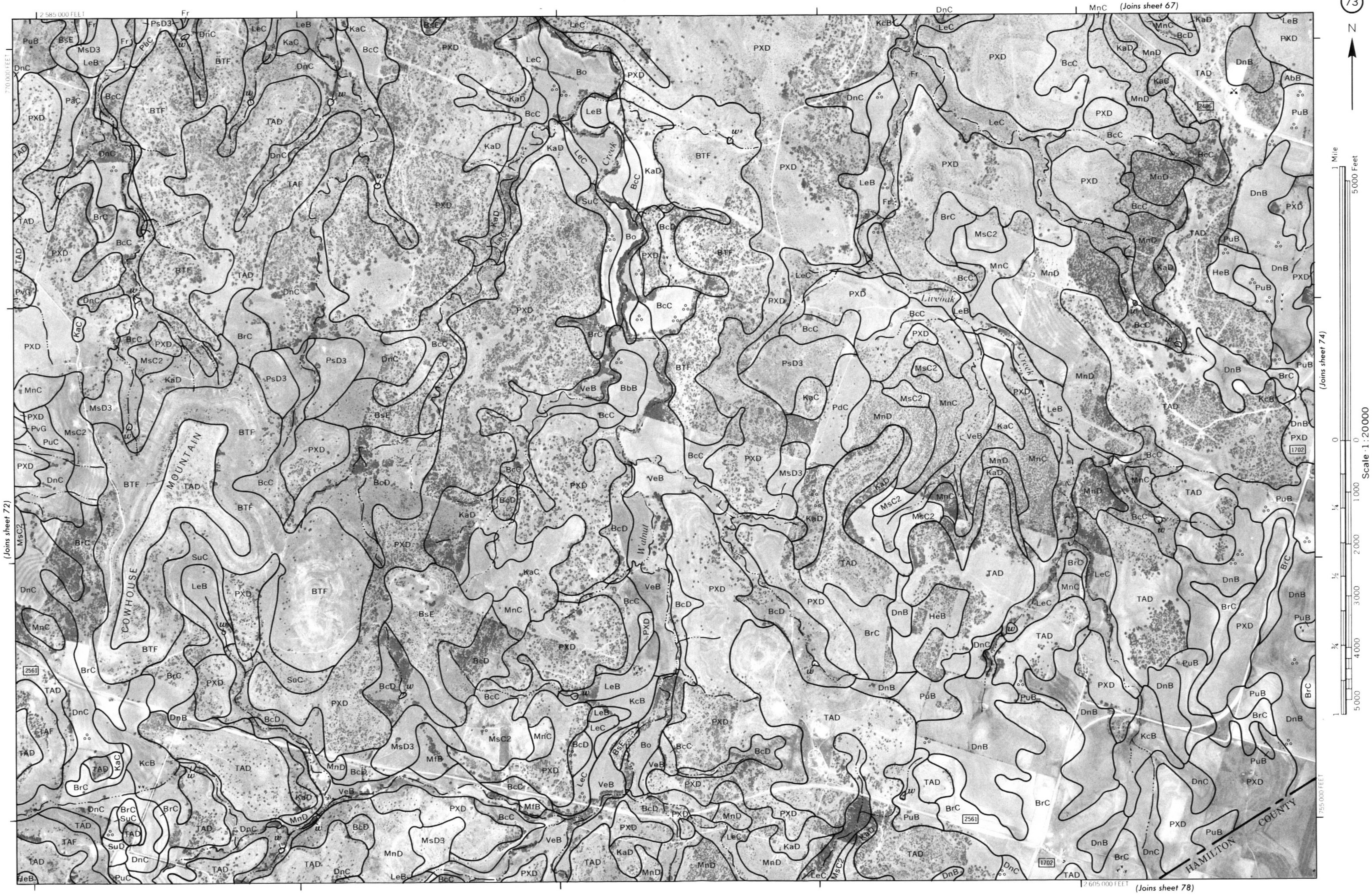
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 72

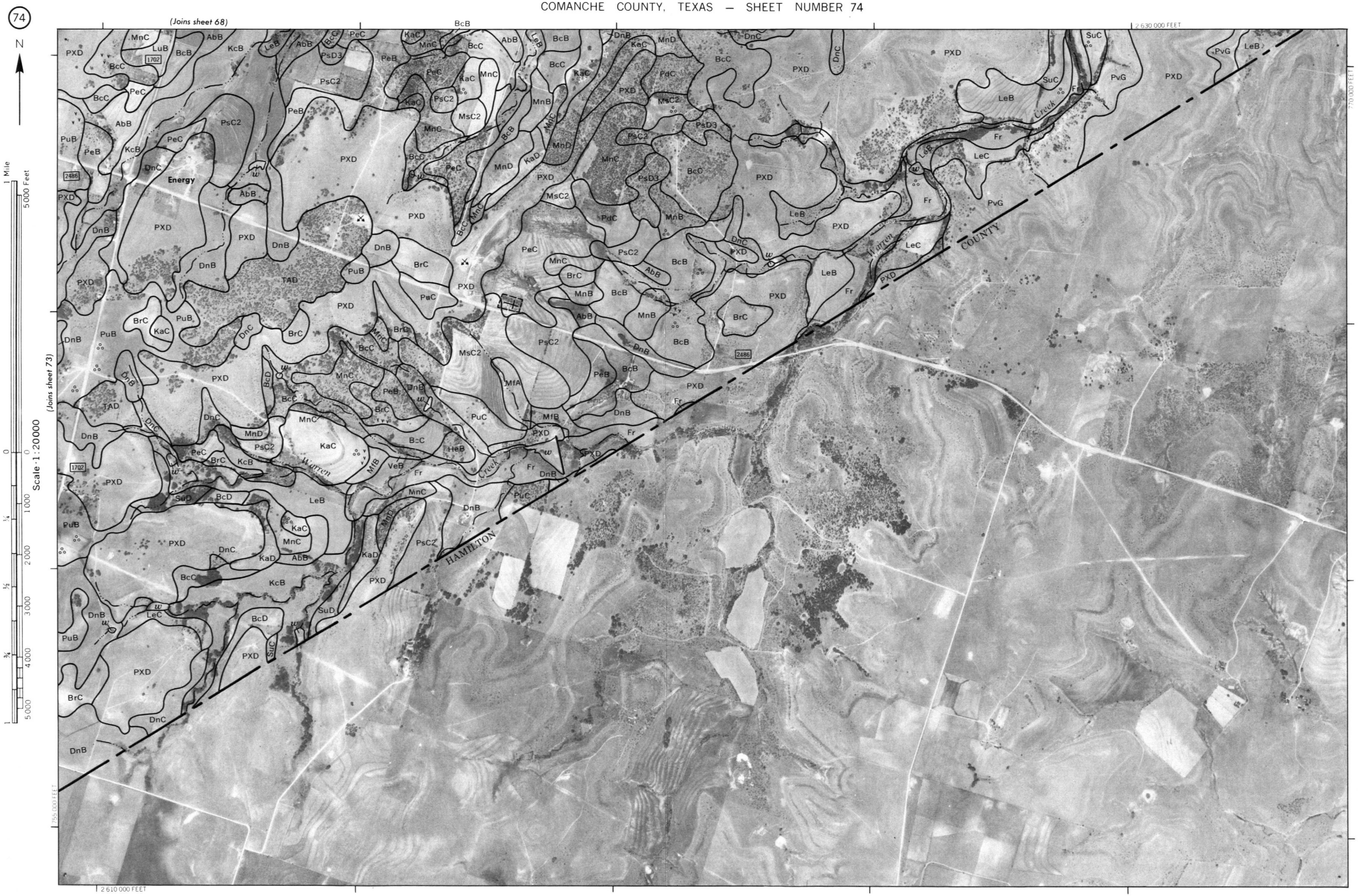
COMANCHE COUNTY, TEXAS — SHEET NUMBER 73

COMANCHE COUNTY, TEXAS NO. 73

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



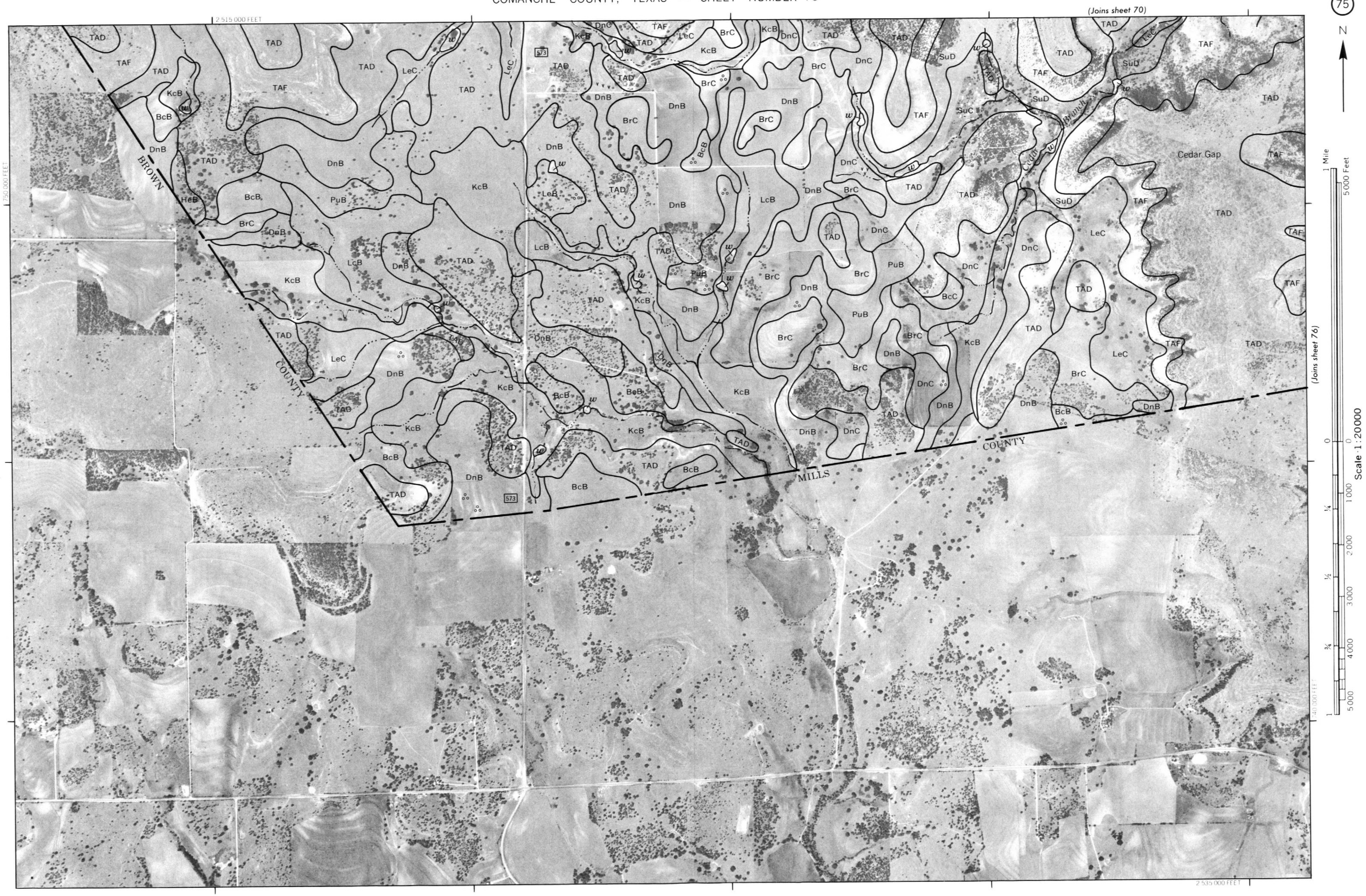
COMANCHE COUNTY, TEXAS — SHEET NUMBER 74



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 74

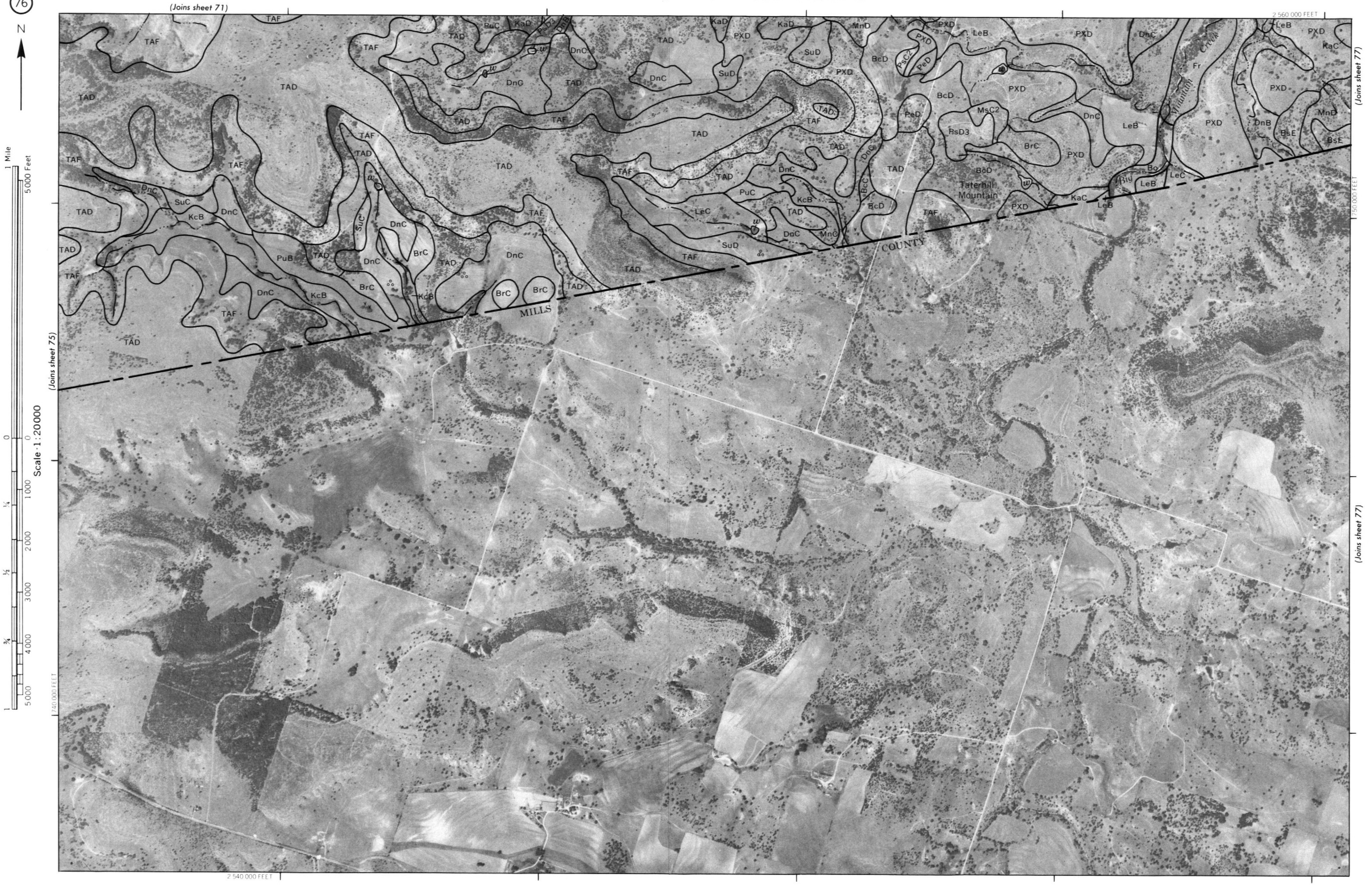
COMANCHE COUNTY, TEXAS — SHEET NUMBER 75



COMANCHE COUNTY, TEXAS NO. 75

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS — SHEET NUMBER 76

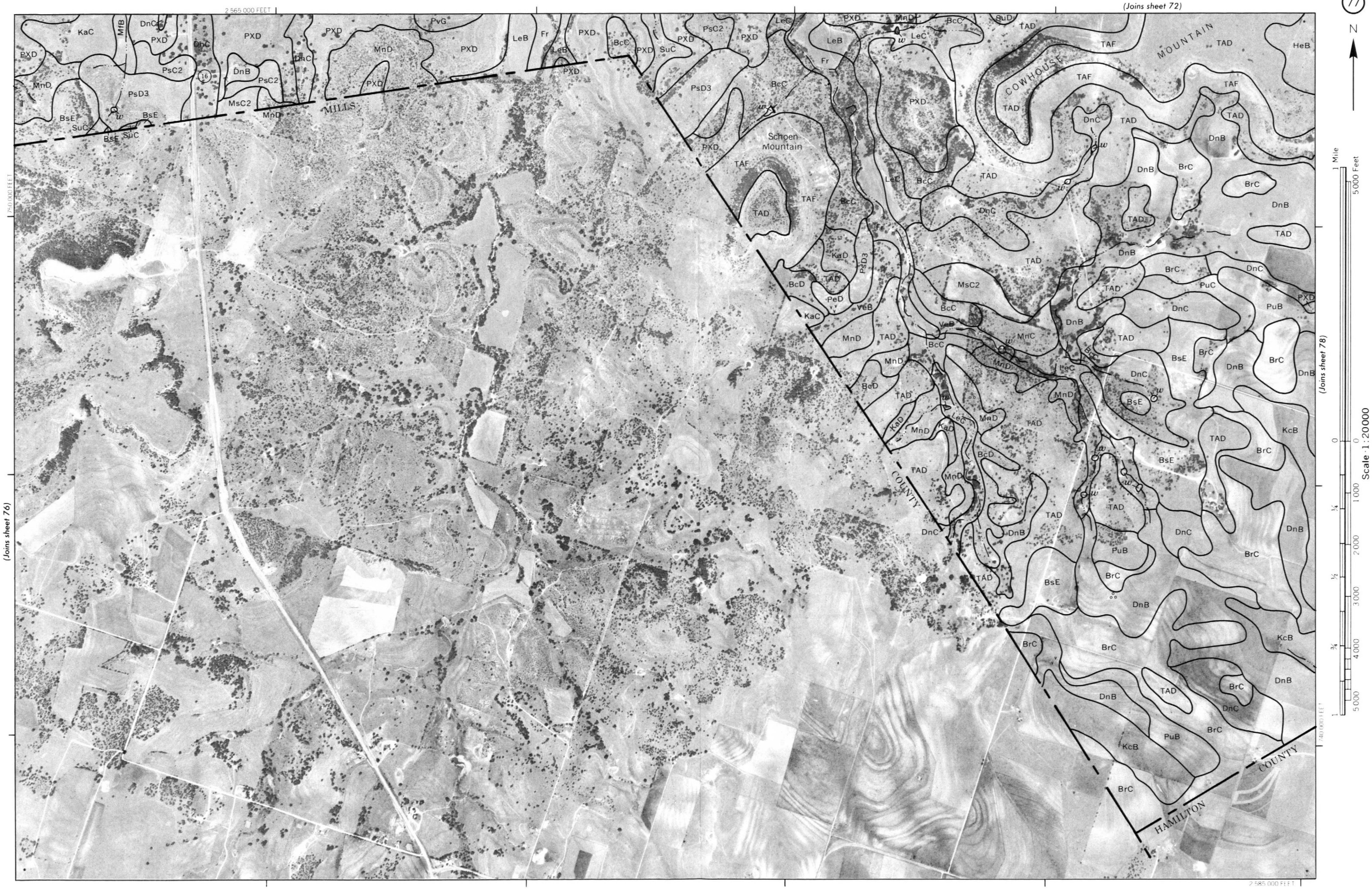


This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

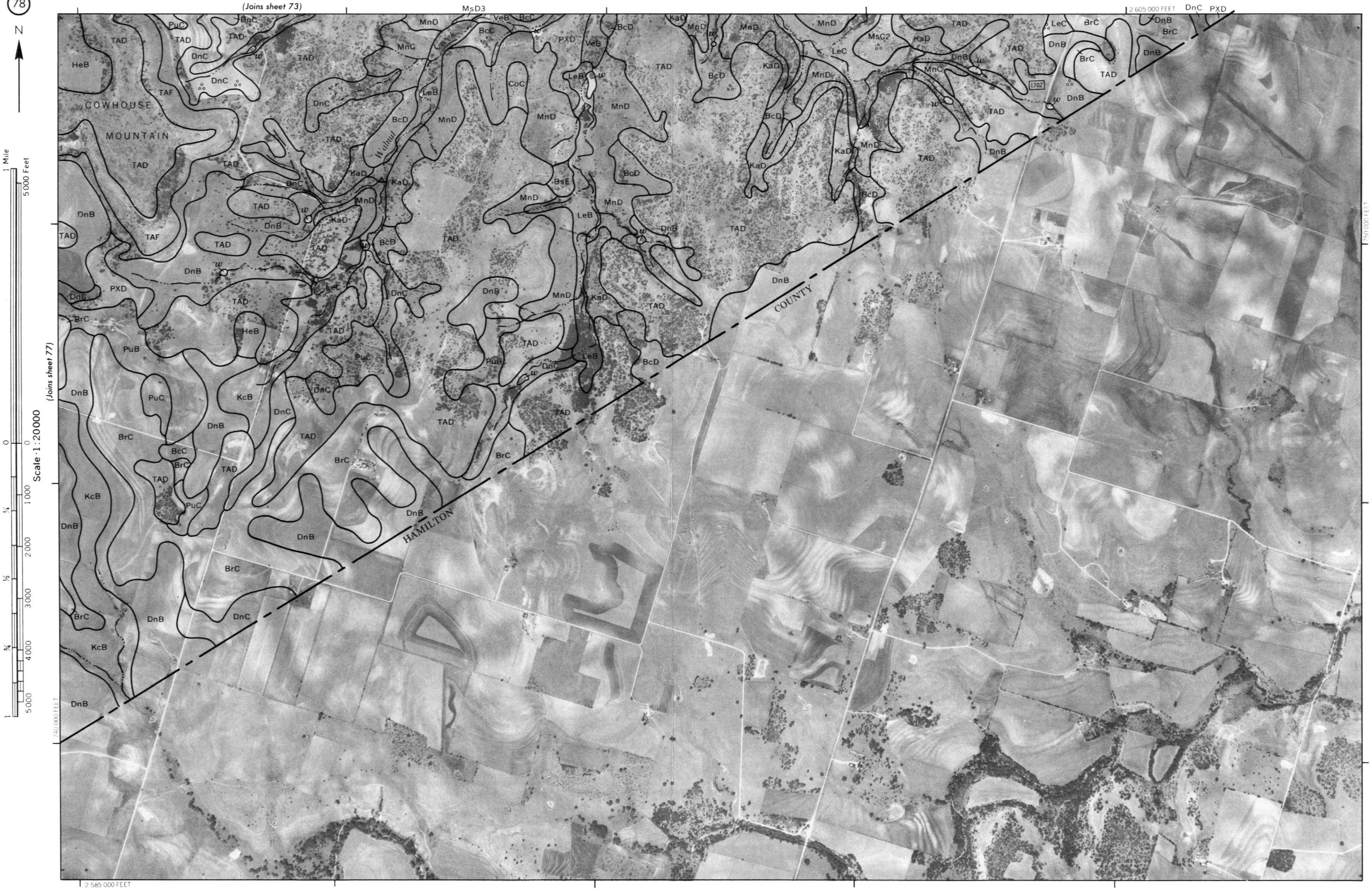
COMANCHE COUNTY, TEXAS NO. 76

COMANCHE COUNTY, TEXAS NO. 77

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



COMANCHE COUNTY, TEXAS — SHEET NUMBER 78



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COMANCHE COUNTY, TEXAS NO. 78